UNITED STATES DEPARTMENT OF LABOR
FRANCES PERKINS, Secretary
CHILDREN'S BUREAU . . KATHARINE F. LENROOT, Chief

Occupational Hazards to Young Workers

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REPORT NO. 4

THE LOGGING AND SAWMILLING INDUSTRIES

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OCCUPATIONAL HAZARDS TO YOUNG WORKERS

Report No. 1. The Explosives-Manufacturing Industries, Publication No. 273.
Report No. 2. Motor-Vehicle Drivers and Helpers, Publication No. 274.
Report No. 3. The Coal-Mining Industry, Publication No. 275.
Report No. 4. The Logging and Sawmilling Industries, Publication No. 276.
Report No. 5. Woodworking Machines, Publication No. 277.

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LETTER OF TRANSMITTAL

United States Department of Labor,
Children's Bureau,
Washington, November 1, 1941.

Madam: There is transmitted herewith a report on the occupational hazards to young workers of employment in the logging and sawmilling industries. This report is the factual basis for a finding and order issued by the Chief of the Children's Bureau declaring logging and sawmilling occupations, with certain exceptions, to be particularly hazardous for young workers and therefore subject to a minimum-age standard of 18 years under the Fair Labor Standards Act of 1938. The report was originally published in mimeographed form on May 2, 1941, when a proposed order on logging and sawmilling occupations was issued. This order in final form, designated as Hazardous-Occupations Order No. 4, was issued on June 24, 1941, and became effective August 1, 1941. It declares all occupations in logging and all occupations in any sawmill, lath mill, shingle mill, or cooperage-stock mill, with certain exceptions, to be particularly hazardous for workers 16 and 17 years of age. A copy of the order appears in the appendix to this report.

It is believed that the industrial-injury data and the discussion of the hazards of employments contained in this report will be of general interest to representatives of management and labor, to safety engineers, to officials of State labor departments and industrial-accident commissions, and to other persons interested in the promotion of safe working conditions in the logging and sawmilling industries.

The Bureau is especially grateful to the members of its Technical Advisory Committee on Hazards of Logging and Sawmilling, composed of representatives of employers and organized workers in the logging and sawmilling industries, of safety engineers, and of officials of State labor departments and industrial-accident commissions, who reviewed a preliminary draft of this report, made valuable suggestions on the basis of their knowledge of the industry and its hazards, and aided in the formulation of the proposed finding and order. The Technical Advisory Committee consisted of two sections, one of which met in Washington, D. C., on December 13, 1940, and one in Portland, Oregon, on February 4, 1941.

The following persons served on the committee, and in a spirit of public service gave their time, experience, and judgment to a consideration of the hazards to young workers of employments in these industries:

Derby Bendorf, Pacific Lumber Company, Scotia, Calif., representing the California Redwood Association.
George F. Cornwall, managing editor, The Timberman, Portland, Oreg.
John A. Dickinson, National Bureau of Standards, U. S. Department of Commerce, Washington, D. C., representing the American Logging and Sawmill Safety Code Committee.

J. J. Farrell, Farrell Lumber Company, Poland, N. Y., representing the Northeastern Lumber Manufacturers Association.
Charles E. Good, vice president, Bay de Noquet Company, Nahma, Mich., representing the Northern Hemlock and Hardwood Manufacturers Association.
M. A. Hutcheson, first general vice president, United Brotherhood of Carpenters and Joiners of America, Indianapolis, Ind.
Worth Lowery, vice president, International Woodworkers of America, Seattle, Wash.
Fred Lumm, logging inspector, State Industrial Accident Commission, Portland, Oreg.
R. McA. Keown, engineer, Safety and Sanitation Department, Industrial Commission of Wisconsin, Madison, Wis.
Ernest A. Merklein, Shreveport, La., representing the Southern Pine Association.
Merton T. Owre, Western Pine Association, Portland, Oreg.
William H. Riley, International Woodworkers of America, Bessemer, Ala.
B. W. Sleeman, general representative, United Brotherhood of Carpenters and Joiners of America, Portland, Oreg.
Ed Sorger, supervisor of safety and industrial relations, Washington Department of Labor and Industries, Olympia, Wash.
W. G. Tilton, first engineer, West Coast Lumbermen's Association, Seattle, Wash.
L. L. Tyler, safety engineer, Portland, Oreg.

The study was planned and carried on under the general direction of Beatrice McConnell, Director of the Industrial Division of the Children's Bureau, and Elizabeth S. Johnson, Assistant Director in Charge of Research. The field work was conducted and the report written jointly by Sheldon W. Homan, safety engineer, and Saul Wallen, associate in hazardous-occupations research. The statistical material on industrial injuries was developed by Miriam Noll, specialist in accident statistics.

Respectfully submitted.

KATHARINE F. LENROOT, *Chief.*

Hon. FRANCES PERKINS,
Secretary of Labor.

OCCUPATIONAL HAZARDS TO YOUNG WORKERS

The Logging and Sawmilling Industries

Because individual accidents occurring under relatively undramatic circumstances receive scant attention from the press, the public is not aware of the extremely hazardous nature of most kinds of work in the logging and sawmilling industries.[1] Recognition of the hazards associated with these employments has been confined largely to safety engineers, officials of State labor departments and industrial-accident commissions, and to leaders of organizations of operators and employees who have direct, frequent contact with these industries and a first-hand knowledge of their working conditions. Unlike accidents in the mining industry, accidents in the logging and sawmilling industries have rarely reached disaster proportions, with many workers killed or injured as the result of one accident. But the many accidents involving only one or two workers and resulting in serious injury or death have, without attracting widespread public notice, made logging the most hazardous manufacturing industry for which adequate, comparable data are available. Sawmilling ranks second. This is true on the basis of the frequency with which accidents occur, as well as in terms of the severity of the resulting injuries.

The logging and sawmilling industries were made the subject of investigation by the Children's Bureau because of their hazardous nature. In general, the minimum age for employment under the terms of the Fair Labor Standards Act of 1938 is 16 years. However, the act places on the Chief of the Children's Bureau the responsibility for determining occupations that are particularly hazardous for persons 16 and 17 years of age. In such occupations it is provided that the minimum age for employment shall be 18 years. The investigation of logging and sawmilling employments, made in accordance with regulations of the Children's Bureau governing the procedure to be followed in making such determinations,[2] was undertaken to determine which occupations in these industries are particularly hazardous for minors and should properly be subject to the 18-year minimum.

At the time of the 1930 census, a considerable number of persons under 18 years of age were reported to be engaged in logging and sawmilling pursuits, and more recent information indicates their continued employment. For this reason, as well as because of their dangerous character, the logging and sawmilling industries were selected for study. Previously completed were studies of the hazards of coal-mine employments, of the hazards of occupations in the manufacture of explosives, and of the hazardous nature of the occupations of driving and serving as helpers on motor vehicles. These studies serve as factual bases for findings and orders declaring those occupations to be particularly hazardous for minors 16 and 17 years of age. A survey of the hazards of woodworking-machine employments for young workers has been completed and will be presented as a companion report to the present one.

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[1] The term "sawmilling" as used in this report should be understood to include lath mills, shingle mills, and cooperage-stock mills operated in connection with sawmills or independently.

[2] Appendix A, p. 70 presents the legal basis of the investigation.

METHOD AND SCOPE OF STUDY

This report presents a description of the hazards of logging and sawmilling employments, statistical data on the nature and extent of these hazards, expert opinion on the advisability of employing young persons under 18 years of age in logging and sawmilling pursuits, and a review of the minimum-age standards for such employments voluntarily maintained by employers or imposed by State laws.

The chief sources of the material used in the report were available statistics on the industries, existing legal restrictions on employment, opinions of representatives of management and labor and of safety experts, and visits to representative logging operations and sawmilling plants.

The statistical material examined included data on production and employment in these industries and on the frequency and severity of accidents, as compiled by Federal, State, and private agencies. Laws regulating the employment of minors in these industries in various States were analyzed. Consultations were held with executives of numerous trade associations, with officers of labor unions, with officials of State labor departments and industrial-accident commissions, and with safety engineers in the employ of private companies, insurance interests, and State and Federal agencies. Finally, visits were made to logging operations and sawmilling plants of various sizes ranging from the small, portable mill employing three to five men to one of the largest in the world, employing thousands. Some of these operations cut softwoods; others, hardwoods. They utilized various production methods, represented varying degrees of mechanization, and operated in areas of varying topography. The operations and mills visited were located in Alabama, Arkansas, California, Georgia, Louisiana, Mississippi, North Carolina, Oregon, South Carolina, and Washington, and detailed information was obtained on the nature and hazards of the different logging and sawmilling occupations.

Persons with expert knowledge of the industries were consulted regarding the hazards involved in logging and sawmilling employments and the customary minimum-age standards for such work. Many of them also expressed their opinions on the hazards of such work for persons under 18 years of age and on the need for applying to these occupations the 18-year minimum age for hazardous employments set by the Fair Labor Standards Act.

The investigation covered the logging of all species of timber except that for use in the manufacture of wood pulp and pulp products. Such timber is generally cut from much smaller trees than saw timber, is usually cut on tracts where only small trees are logged, requires little power equipment, and involves types of hazards different from those found in ordinary logging. Also, pulpwood logging is often conducted by enterprises engaged in the mnaufacture of paper and pulp or is closely related to them. For these reasons this type of logging is to be considered in connection with a study of the paper and pulp industry.

The investigation of logging operations was concerned with all occupations contributing directly or indirectly to the felling of trees and their transportation to the log pond or storage yard and included those pertaining to camp maintenance; planning and construction of roads, rail lines, or other facilities before the actual logging is begun; handling and transportation of the logs to the sawmill; and the protection of forests.

Some logging companies which practice selective logging perform work in timber culture and timber-stand improvement in the logged-over or reforested portions of their holdings. Such work is done also on public lands by various government agencies. Since these occupations are more closely related to forestry than to logging even when such work is conducted by a logging company, their hazards have not been dealt with in this report.

The investigation also covered the sawmilling industries, including sawmills engaged solely in the conversion of logs into rough lumber, lath mills, shingle mills, and cooperage-stock mills. These latter establishments are actually specialized types of sawmills, utilizing much of the same equipment and, in addition, machines designed to produce their special products.

All the occupations followed in the sawmilling industries were investigated. Sawmilling occupations include all those contributing to the conversion of logs, bolts, or scrap wood into rough lumber, laths, shingles, or cooperage stock and those concerned with storing, drying, and shipping the raw materials or finished products.

Many sawmilling establishments have planing-mill departments where rough lumber is finished and patterned lumber and millwork are produced, and operate other departments, such as box factories, plywood mills, or furniture factories, where lumber is remanufactured. Occupations in these departments were not included in the scope of this study, but their hazards are being studied in connection with an investigation of the hazards of woodworking-machine employments for young workers.

Some logging operations and sawmills have shops for the maintenance of equipment and tools. Mechanics, blacksmiths, electricians, repairmen, boilermakers, welders, and others employed in the shops perform the same work and are confronted by the same hazards as workers in these occupations in other industries. Consequently, these occupations have not been dealt with specifically in this report but will be the subject of separate study.

Logging workers, and sometimes sawmill workers, are occasionally called upon to fight forest fires in the vicinity of their jobs. Forest fires are regarded as a community emergency, and these workers are subject to call by their employers or by fire wardens or other public authorities. Indeed, sometimes the services of every able-bodied person in the vicinity of a forest fire are required. There is much danger connected with fire-fighting, but it is not in itself a regular logging occupation. Rather, it is an emergency duty to which all logging employees are subject. Because of its emergency character, it has not been included in this report as coming within the scope of logging and sawmilling occupations.

CHARACTERISTICS OF THE INDUSTRIES

Location

The lumber industry has been called "a nomad among American industries."[1] Up to about 1870, the Northeastern States were the greatest source of lumber in the United States. With the development of the upper Mississippi Valley, the Lake States of Wisconsin, Minnesota, and Michigan produced most of the lumber. By 1900 the lead in lumber production had passed to the South where it remained until 1925. During this period the forests of the Far West became an increasingly important factor in national production, and by 1926 this area had assumed the lead.

Today, 50 percent of the saw-timber stand in the United States is in the Pacific Northwest; 19 percent is in California and the South Rocky Mountain States; 22 percent is in the South. The remaining areas account for only 9 percent of the Nation's present and potential timber supply.[2]

The tremendous forests of the West are composed almost entirely of softwoods. Many species are cut in this area, but the four of outstanding commercial importance are Douglas fir, western hemlock, western red cedar, and Sitka spruce.[3]

The South is of great importance as a source of both hardwoods and softwoods. About 45 percent of the stand in this region is of the former type with oak, red gum, and tupelo the predominating species. The remainder of the stand is softwood, the greatest part of which is southern yellow pine.[4]

More than half of the timber stand of the Northeastern and Lake States is composed of hardwoods, and although only a small part of America's forests are located in these regions, they play an important role as suppliers of hardwood timber.

Lumber is produced in 47 of the Nation's 48 States, but in many of them the cut is so small that even the local demand must be met by shipments from other parts of the country. In 1938, Oregon and Washington together produced one-third of all the lumber sawed in the Nation. Alabama, California, Mississippi, North Carolina, and Texas also were sources of large quantities. Table 1 shows the total production of lumber in the more important States in 1938 and the percent of the national total produced by each State.

Production and Employment

The peak of lumber production in the United States was reached in 1906, when the American forests yielded 46 billion board feet of lumber. But new materials, often more durable and efficient, have been encroaching on the markets for which the forests were formerly the only source of supply. The result has been a drop in production, interrupted only by the building boom of the early 1920's, from 46 billion board feet in 1906 to 10 billion board feet in 1932.[5] Since that time there has been a substantial increase in production, which in 1938 amounted to 22 billion board feet.[6] Current reports indicate that as a result chiefly of the demands of the national-defense program, lumber production has advanced considerably above the 1938 level but is still far below the 1906 peak. Despite the decline in production since 1906, lumber remains one of the most important of the basic commodities.[7]

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[1] The Lumber Industry of Washington, by William Ray Melton, p. 6. Industrial Study No. 1, National Youth Administration of Washington, Tacoma. October 1938.

[2] Lumber Industry Facts, 1939, table 3, p. 5. National Lumber Manufacturers Association, Washington, 1939.

[3] Logging in the Douglas Fir Region, by William H. Gibbons, pp. 2, 3. Bulletin No. 711, U. S. Department of Agriculture. Washington, 1918.

[4] Lumber Industry Facts, 1939, table 4, p. 6.

TABLE 1.—*Production of lumber in important lumber-producing States, 1938*

State	Aggregate lumber sawed (M board feet)	Percent of total production	State	Aggregate lumber sawed (M board feet)	Percent of total production
United States	21, 646, 271	100. 0	Louisiana	946, 258	4. 4
Oregon	3, 790, 896	17. 5	Arkansas	934, 846	4. 3
Washington	3, 348, 567	15. 5	Georgia	805, 017	3. 7
California and Nevada	1, 461, 961	6. 8	Florida	624, 269	2. 9
North Carolina	1, 370, 503	6. 3	South Carolina	587, 804	2. 7
Alabama	1, 212, 054	5. 6	Idaho	570, 571	2. 6
Mississippi	1, 189, 692	5. 5	Virginia	511, 662	2. 4
Texas	1, 028, 385	4. 7	Other States [1]	3, 263, 786	15. 1

[1] No one of these States produces as much as 2 percent of the total production.

Source: Forest Products—1938, Lumber, Lath, and Shingles, table 8, p. 14. U. S. Bureau of the Census, Washington. November 1939.

The economic importance of the industry is indicated also by its rank as an employer of labor. In 1937 the lumber- and timber-products industry gave work to an average of 323,928 wage earners;[8] it ranked third among all major manufacturing industries in this respect, being exceeded only by the steel works and rolling-mill-products industry and the cotton woven-goods industry.[9] In the State of Washington, 48 percent of all the wage earners were engaged in the lumber- and timber- products industry; in Oregon, 55 percent; in Arkansas, 46; in Mississippi, 37; in Louisiana, 27.[10] Of the nearly 324,000 wage earners employed in the forests and mills, 154,000 worked in 11 southern States, 103,000 worked in 3 States on the Pacific coast, and the remainder were scattered throughout nearly all the other States in the country.[11]

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[5] Lumber Production, 1869–1934, compiled by Albert H. Pierson under direction of R. V. Reynolds, p. 74. Division of Forest Economics, Forest Service, U. S. Department of Agriculture, Washington, 1936.

[6] Forest Products: 1938, Lumber, Lath, and Shingles, p. 4. U. S. Bureau of the Census, Washington, November 1939.

[7] The data on production and employment presented in this section, while the best available, are an understatement of the actual situation, since they do not include the output of mills producing less than 50,000 board feet of lumber (or its equivalent in lath and shingles) and do not include wage earners in establishments whose products were valued at less than $5,000. (In earlier censuses a mill that sawed 200,000 board feet of lumber or its equivalent in lath and shingles was treated as an establishment with products valued at $5,000.) In 1937 there were 7,647 mills whose value of product was $5,000 or more, whereas the mills reporting a production of 50,000 or more board feet of lumber numbered 13,916. Although the mills producing less than $5,000 worth of lumber are small, intermittently operated establishments, they are believed to account for a considerable number of employees.

[8] The great proportion of these workers are employed in logging operations, sawmills, and cooperage-stock mills, the hazards of which are discussed in this report. A relatively small number are employed in planing mills operated in connection with sawmills and in veneer mills; some of the hazards of employment in these factories are discussed in the report on the hazards of woodworking-machine employments for young workers.

[9] Biennial Census of Manufactures: 1937, part I, General Summary, table 5, p. 34. U. S. Bureau of the Census, Washington, 1939.

[10] Lumber Industry Facts, table 20, p. 15.

The lumber industry is largely interstate in character. Little more than one-fourth of the lumber cut in Washington and Oregon is marketed within those States. The remainder is shipped to other parts of the country or abroad. In North Carolina 42 percent, in California 38 percent, in Alabama 63 percent, in Mississippi 69 percent, and in Louisiana 59 percent of the cut reported in statistics of the industry moves in interstate or foreign commerce, the remainder being retained within the State. Similar percentages move across the lines of all the important lumber-producing States. In general, interstate distribution is principally from large mills, and the bulk of the lumber from small mills remains in the State.[12] By far the greater proportion of employment is accounted for by the large mills.

Employment of young persons.

Precise data on the number and age of youths currently employed in logging operations and in saw and planing mills are not available. However, information from two sources tends to represent the upper and lower limits of such employment and indicates that the number actually so employed is somewhere between these extremes. According to the 1930 census, 20,761 minors under 18 years of age were reported as gainfully occupied in that year in logging and in saw and planing mills.[13] Nearly one-fourth (5,025) of these young people were performing work in logging operations, and the remainder worked as operatives and laborers in sawmills and planing mills. These young workers constituted 3 percent of the total number gainfully occupied in lumbering and 5 percent of the total number gainfully occupied as operatives and laborers in sawmills and planing mills.

Logging operations in 18 States employed 78 percent of the 5,025 young logging workers. Twelve of these States are in the South. The remaining 22 percent were scattered throughout the other States, no one of which had as many as 3 percent (table 2). Of the young workers employed as operatives and laborers in sawmills and planing mills 79 percent worked in 14 of the 18 States in which the great majority of the logging workers were employed (table 3).

There are several factors which may explain the concentration of employment of young persons in the South. One is the greater number of small sawmills in this area. Another is the fact that of the nearly 21,000 persons under 18 in the industry in 1930, more than 7,000 were Negroes, who are found chiefly in the southern States. The low-income level of Negro families as compared with white families is generally recognized. As a result, a greater proportion of Negro children are under pressure to enter the labor market in order to supplement the small incomes of their families.

Several factors indicate, however, that the number of young workers at present employed in logging and sawmilling pursuits is

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[11] Computed from Biennial Census of Manufactures: 1937, part I, Lumber and Timber Products, table 2, p. 502.

[12] Lumber Distribution and Consumption for 1936, Forest Research Project Report No. 1, pp. 5–7, and table 1, p. 12. U. S. Forest Service, Washington, 1938.

[13] Computed from Fifteenth Census of the United States, 1930, Population, vol. V, table 6, pp. 118–137. Washington, 1933.

TABLE 2.—*Minors 10 to 17 years of age gainfully occupied in lumbering occupations in specified States, 1930* [1]

State	Minors 10 to 17 years					
	Total		10 to 15 years		16 and 17 years	
	Number	Percent	Number	Percent	Number	Percent
United States	5, 025	100. 0	1, 047	100. 0	3, 978	100. 0
Washington	329	6. 5	29	2. 8	300	7. 5
Oregon	281	5. 6	28	2. 7	253	6. 4
Louisiana	276	5. 5	80	7. 7	196	4. 9
Florida	257	5. 1	76	7. 3	181	4. 6
Arkansas	246	4. 9	80	7. 6	166	4. 2
North Carolina	238	4. 7	47	4. 5	191	4. 8
Virginia	240	4. 8	62	5. 9	178	4. 5
Georgia	236	4. 7	61	5. 8	175	4. 4
Tennessee	233	4. 6	61	5. 8	172	4. 3
Mississippi	204	4. 1	48	4. 6	156	3. 9
Alabama	199	4. 0	53	5. 1	146	3. 7
Michigan	188	3. 7	15	1. 4	173	4. 3
West Virginia	184	3. 7	25	2. 4	159	4. 0
Missouri	167	3. 3	45	4. 3	122	3. 1
Texas	164	3. 3	56	5. 3	108	2. 7
Maine	158	3. 1	24	2. 3	134	3. 4
Pennsylvania	157	3. 1	13	1. 2	144	3. 6
South Carolina	154	3. 1	42	4. 0	112	2. 8
Other States	1, 114	22. 2	202	19. 3	912	22. 9

[1] Children 10 to 17 years of age in forestry occupations were reported gainfully occupied only as "teamsters and haulers" and as "other lumbermen, raftsmen, and woodchoppers."

Source: Compiled from Fifteenth Census of the United States, 1930, Population vols. IV and V. U. S Bureau of the Census, Washington.

less than it was in 1930. Experience in other industries indicates that the employment of young persons tends to rise or fall with that of adults. It is likely, therefore, that the general decline in employment in the logging and the sawmilling industries since 1930 has been accompanied by some decrease in the employment of young people.

TABLE 3.—*Minors 10 to 17 years of age gainfully occupied as operatives and laborers in saw and planing mills in specified States, 1930*

State	Minors 10 to 17 years of age					
	Total		10 to 15 years		16 and 17 years	
	Number	Percent	Number	Percent	Number	Percent
United States	15, 736	100. 0	3, 181	100. 0	12, 555	100. 0
Georgia	1, 536	9. 8	419	13. 2	1, 117	8. 9
Alabama	1, 496	9. 5	342	10. 7	1, 154	9. 2
Mississippi	1, 167	7. 4	293	9. 2	874	7. 0
North Carolina	1, 102	7. 0	240	7. 5	862	6. 9
South Carolina	1, 045	6. 6	277	8. 7	768	6. 1
Florida	1, 004	6. 4	310	9. 7	694	5. 5
Virginia	934	5. 9	191	6. 0	743	5. 9
Louisiana	833	5. 3	194	6. 1	639	5. 1
Washington	701	4. 5	59	1. 9	642	5. 1
Arkansas	655	4. 2	164	5. 1	491	3. 9
Tennessee	596	3. 8	127	4. 0	469	3. 7
Texas	554	3. 5	107	3. 4	447	3. 6
Oregon	482	3. 1	43	1. 4	439	3. 5
Pennsylvania	380	2. 4	56	1. 8	324	2. 6
Other States	3, 251	20. 6	359	11. 3	2, 892	23. 0

Source: Compiled from Fifteenth Census of the United States, 1930, Population, vols. IV and V.

In addition, since 1930 a number of States have raised the legal minimum age for employment or for leaving school. Another factor which tended to reduce the number of young persons employed since 1933 was the provision in the N. R. A. Code of Fair Competition for the Lumber and Timber Products Industry that "no individual under 18 years of age shall be employed, except that boys 16 years and over may be employed in the Wooden Package Division and in nonhazardous occupations during school vacations or if there are no wage earners of 18 years or over in their families." Although the codes ceased functioning in May 1935, their effect on child labor probably has continued to some extent.

That employment of young workers in the logging and sawmilling industries continues, although at a reduced level, is indicated by examination of figures of the Social Security Board on the number of workers under 18 years of age in the basic lumber industries reported as earning taxable wages. In the last quarter of 1938 there were 3,333 such workers, and they constituted 1 percent of the total number of workers of all ages in these industries. However, this figure undoubtedly understates the actual extent of employment of young workers in these industries for three reasons. First, the data represent employment during only one quarter and not employment for the entire year. In some parts of the country this quarter corresponds to the slack season in the industries. Second, because of the existence of small, isolated, sometimes intermittently operated logging operations and sawmills, it has probably not been possible to secure complete reporting of taxable wages. Third, the data do not reflect employment of youths during the summer-vacation period, a time of the year when many are likely to be employed in these industries.

In the light of these facts, it is fairly safe to assume that the 1930 figures on employment of young persons represent the maximum and the Social Security Board data represent the minimum number of minors under 18 years of age employed at present. The continued employment of young persons under 18 years of age in logging operations and in sawmilling plants is indicated by the issuance in some localities of employment certificates for work in logging operations, sawmills, and other sawmilling plants,[14] and by the reports of inspections of logging operations and sawmills made by the Children's Bureau under the Fair Labor Standards Act of 1938. That minors under 18 years of age not only continue to be employed but also suffer injuries arising out of their employment in logging and sawmilling is revealed by data from some State industrial-accident commissions showing the age of workers who have been injured or killed in these occupations. In the State of Oregon in 1938, for example, 55 industrial accidents to 16- and 17-year-old logging and sawmilling workers were reported to the State Industrial Accident Commission. Of this number, 37 were lost-time injuries.[15]

The expansion in production and employment resulting from the national-defense program, coupled with the decrease in the labor supply resulting from the expansion of the Nation's armed forces, may be the basis for an increase in the employment of young workers in the logging and sawmilling industries. During the course of the investigation some logging and sawmilling operators stated that while they adhered to a policy of not employing persons under 18 years of age at present, this policy would be relaxed if a labor shortage developed. It is likely if present trends continue that the employment of 16- and 17-year-olds in these industries, with consequent exposure to their many hazards, will materially increase if such employment is permitted.

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[14] In Washington 346 certificates were issued to minors under 18 years of age for work in the logging and woodworking industries during the period from January 1, 1938, to December 31, 1939.

[15] Unpublished data from the State Industrial Accident Commission, Salem, Oreg.

Occupations of young workers.

There is little factual material showing the occupations of young workers in the logging and sawmilling industries. The meager data available indicate that young people are employed to a varying extent in most, if not all, of the logging occupations which do not require a great deal of experience. Until relatively recent times, the occupation of whistle punk or signalman was traditionally a job filled by boys. The job of wood buck was often filled by young workers. Brush piling is still done by boys under 18 working either during school vacation or on an all-year basis. In the southern woods, the employment of boys to drive horses, to remove tongs or grabs from logs after they have been hauled to the landing, to carry water, and to perform similar work has been reported.

In some instances young workers hold jobs ordinarily filled by older, more experienced men. Employment certificates issued to boys under 18 years of age for employment in logging operations in one important lumber-producing State included the following occupations: faller, bucker, hook tender, chokerman, landing man, loader, limber, swamper, tractor operator, whistle punk, fireman, brush piler, wood splitter, laborer in camp construction, laborer in railroad construction, handyman, and fire warden. Reports of field investigations made in various other States confirm the fact that young people are sometimes employed in these occupations.[16]

In sawmilling also certain occupations have been traditionally filled by boys. Young workers were often employed as ripsaw and crosscut-saw tailers, as packers in shingle mills, as stock pickers in lath mills, as tiers in lath mills and in storage sheds of sawmills and planing mills, and in numerous capacities in box factories. Many of these jobs are still filled by boys. Certificates issued to young workers in lumber mills in the State referred to above were for work in such occupations as laborer, lumber handler, truck driver, helper, tier, transfer helper, off-bearer, ripsaw tailer, yard worker, clean-up man, fireman, swinging-cutoff-saw operator in a shingle mill, shingle packer, and lath trimmer. Reports of visits to sawmilling plants in other States, especially in the South, mention instances of young workers employed as doggers, block setters, log turners, and edger men in small sawmills, as lumber handlers and stackers in the yards of sawmills, as packers in shingle mills, and as boltermen, pickers, and tiers in lath mills.[17] The nature and degree of hazard associated with these occupations are discussed in later sections of this report.

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[16] For description of the work performed by persons engaged in these occupations, see pp. 11–19.

[17] For description of the work performed by persons engaged in these occupations, see pp. 40–47.

THE LOGGING INDUSTRY

Because of the difference in the nature of the work and because the logging site changes with the exhaustion of the timber and is generally a considerable distance from the sawmill, logging and sawmilling operations are conducted as separate units, each under the supervision of its own superintendent. Because the work is different, the types of hazards which confront woods workers and mill workers differ greatly.

For these reasons this report discusses first logging operations and the hazards of logging occupations and second, sawmilling operations and hazards. The discussion of logging and sawmilling methods and occupations is presented in considerable detail to provide a background for analysis of the hazards of the various occupations.

Methods and Occupations

The first step in logging is logging engineering or planning and laying out the woods operations and building roads to open up the tract. Next, construction crews build railroads or truck roads, trails, skidways, or flumes, depending upon the method selected for transporting the logs. Machinery for yarding the logs is moved in and, where living accommodations for the loggers are necessary, quarters are erected. Next, trees are felled and then bucked—that is, cut into log lengths. After that the logs are moved to a point accessible to railroad or truck; this process is known as skidding or yarding. At that point the logs are loaded. Transportation by rail or truck, or by booming and rafting, and unloading at the sawmill are the final steps in logging.

Part of the logging process, although not concerned directly with the handling of logs, is the maintenance of the living quarters, of equipment, and of the railroad or right-of-way. In addition, there are a number of miscellaneous occupations, such as piling brush, felling snags, barking logs, or acting as fire warden or lookout.

Logging engineering and road construction.

The planning and laying out of the logging operation are done by the logging superintendent or by a logging engineer in the case of large companies. He cruises the tract, prepares topographical maps, and marks the boundaries of the section to be logged. From these data he plans the logging methods and the location of rail lines or roads and landings. The roads and boundaries are surveyed by a crew consisting of a *transit man*, *rodman*, and *chainman*. The open, level forests of the South require less preliminary planning of this type than the dense, hilly timber tracts of the Northwest.

Next, construction crews build railroads or truck roads, trails, skidways, or flumes, depending upon the method of transportation selected. The railroad construction department is usually in charge of right-of-way maintenance also. The *grade and track crew*, supervised by a *section foreman*, builds and maintains the railroad and performs the necessary grading, cutting, filling, and bridge building. In the crew are *steel men*, who lay the rails; *graders* or *section men*, who prepare the right-of-way; *shovel engineers*, *firemen*, and others who operate power shovels used in grading and fill work; *powdermen*, who do the blasting of rocks or stumps from the right-of-way; a *jackhammer operator* or *driller;* and other *laborers* or *swampers*. *Trackwalkers* patrol the track and make temporary repairs.

If the logging operation is located at a considerable distance from a town, as is often the case in the West but rarely the case in the South, living accommodations for the loggers are necessary, and a complete camp is built or transported from another site.

Felling and bucking.

Fallers cut down the trees and *buckers* cut them into log lengths. In the Northwest these operations are usually performed by separate crews; in the South and other sections bucking is usually done by the felling crew. *Fallers* and *buckers* generally work under the direct supervision of a *bull bucker* or *head bucker*. He indicates the trees to be cut, sometimes determines the direction of fall, and marks off the log lengths. A *scaler* measures the logs cut by each of several felling and bucking crews and credits each crew with the amount of work done. Frequently, the job of *scaler* is combined with that of *bull bucker*.

Felling involves two operations—making an undercut and a final felling cut. A wedge-shaped notch, or undercut, is made in the trunk of the tree in the direction of fall to guide the tree and to prevent it from splitting before it is completely severed from the stump. The felling cut, made with a crosscut saw, is started slightly above and opposite the undercut. As the cut becomes deeper, steel or hardwood wedges are driven in behind the saw to prevent binding. Not infrequently the height of the stumps cut and the size of the root swellings make the use of springboards desirable. Springboards are planks driven into a notch made in the tree trunk, the projecting portion of the plank forming a platform on which the *fallers* stand. Springboards are used extensively in the Northwest but less frequently in other sections of the country. In the cypress swamps of the South *fallers* and *buckers* frequently work from flat-bottomed boats. This increases the difficulty of felling and is considered more hazardous than the conventional method of cutting down timber.

In bucking, the men may work singly or in pairs. It is a rather general practice in the Northwest for *buckers* to work alone using a crosscut saw. In the South, and largely in other lumbering sections where the *fallers* do their own bucking, the general practice is for pairs of workers with a two-man saw to cut the tree into logs. Sometimes power-driven dragsaws are used for bucking, especially when the logs are large.

In the smaller timber of the South and in the Lake States, the general practice is for the bucking crew to cut off the limbs with a swamping ax. This may also be done by a *swamper* working with the felling and bucking crew. In the Northwest lumber region, limbing is usually done by a man working with the yarding crew. He may be known as a *limber*, *knotter*, or *swamper*, depending upon the locality.

Saws and axes require constant sharpening. This is done by a *filer*, who is an expert in filing and setting saw teeth and in sharpening axes.

Skidding or yarding.

The next major process involves the transportation of the log from the stump to the sawmill. The initial step, known as skidding or yarding, is the collection of the logs from places where they have been felled and their assembly at a common point in preparation for further transportation. This common point, known as a landing, may be at a railroad, truck road, or other place, depending upon the method to be used in the transportation of the logs.

Skidding practices vary greatly in different sections of the country and in different logging operations in the same general locality. The factors which determine the choice of skidding methods to be used include the size of the area to be logged, the size of the logs, topography of the country, climate and soil conditions, and the need for saving young forest growth. No operation in logging is less standardized than that of skidding. However, there are three main methods: (1) power skidding, (2) tractor skidding, and (3) animal skidding.

Power skidding is widely used in the dense stands of the Pacific coast. It was once widely used in the South, but the exhaustion of the heavy stands of timber as well as the improvements in logging tractors has led to an increased use of tractors and animals on the smaller operations remaining. A recent study on mechanization in the lumber industry states that "stands too sparse or too scattered to justify the moving and rigging costs of the cable yarder may frequently be logged with profit by tractor because of its greater mobility."[1] Development of heavier tractor equipment in recent years has stimulated the use of tractors for skidding in the Northwest also. In general, it may be said that power skidding continues to be the important method employed in the northwestern forests, although the use of tractors, sometimes in conjunction with cable yarders and sometimes as the sole method of skidding, has increased greatly.

On the other hand, in the South animals are still employed extensively in hauling logs from the stump to the landing in both pine and hardwood operations. Tractors are used to a considerable extent in operations of all sizes; skidders operated by gasoline engines are used largely in medium-sized mills; steam-powered skidders are used in some large operations but are virtually unknown in the small and medium-sized operations. Trucks making the haul directly from the stump are also used extensively. Skidding methods have a considerable bearing on accident experience since some are more dangerous than others.

Power skidding.—Since power skidding, usually referred to as yarding, involves the use of a considerable amount of mechanical equipment it is more hazardous than other methods. Power skidding is the method of collecting and assembling logs at a landing by using cables to drag the logs, power being supplied by a donkey engine stationed at the landing. Logs may be dragged along the ground or may be partially or fully suspended in the air from overhead cables. Power yarding is used mainly in the forests of the West where large, heavy logs are moved and where the topography is not well adapted to the use of tractors or animals. In the Lake States tractors, sleighs, and ice skid-roads are used almost exclusively, and in the South tractor and animal skidding has largely replaced power skidding.

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[1] Mechanization in the Lumber Industry, by Alfred J. Van Tassel, p. 16. National Research Project, Report No. M–5. Work Projects Administration, Philadelphia, Pa. March 1940.

There are three principal methods of power yarding—ground yarding, high-lead yarding, and overhead yarding. In ground yarding, the yarder engine is placed in position at the landing, a main or haulage line is run out to the section to be logged, and a haul-back or trip line is attached to the main line to return the latter for the next log. Generally, a ground-yarding crew is composed of from 8 to 12 persons depending upon the size of the operation. The crew is under the supervision of a foreman, known as a *hook tender*, who plans the work, supervises the laying out of the lines, and ascertains that they are properly attached to trees or stumps near the ground by means of lead blocks or pulleys. He is also responsible for locating the roads along which the logs are dragged from the stump to the landing and for designating the order in which the logs are to be moved.

The laying out of the lines in ground yarding is done by the *hook tender's chief assistant*, known as the *head rigging slinger*, who in turn may be assisted by other *rigging slingers*. The actual yarding of the logs is now begun. On some operations this is done by the *rigging slingers*. On others, where a number of yarder engines are operated simultaneously, the *rigging slingers* may spend all their time rigging up lines and cables at various logging sites. In such cases the yarding of the logs is done by a separate crew.

Included in this crew is a *swamper* who knots or limbs the logs, if this has not already been done by the felling and bucking crews, fells small timber and clears brush that would interfere with the movement of logs, and improves the road where necessary. Then *chokermen* or *chokesetters* place cable nooses or slings, called chokers, around one end of the log and attach them to butt chains, which are short sections of heavy chain in turn attached to the main line. The yarder engine then hauls in the main line, spooling it on a drum, and the logs are dragged along the ground over a cleared yarding road to the landing. The *chaser* unhooks the choker in order to permit the butt chain to pass a tree or stump, holds the main line in place, and rehooks the choker after it has passed the tree or stump. The *signalman*, usually called a *whistle punk*, transmits signals for stopping and starting the yarder engine as he receives them from the *hook tender*, *rigging slinger*, or *chaser*. Before the logs are moved, their front ends have been rounded off by a *sniper* so that they will skid or slide along the ground more easily. When the log reaches the landing the choker is removed by a *chaser*, and it is now ready to be loaded for its next step in transportation to the sawmill. The yarder engine is operated by a *yarder engineer* sometimes referred to as a *skidder leverman*. A *fireman* maintains steam pressure in the wood-burning boiler. A *wood bucker*, more commonly referred to as a *wood buck*, cuts the wood into pieces to fit the firebox.

High-lead yarding involves no great modification of ground yarding. The lead block is attached to a spar tree as high as practicable from the ground, instead of to a stump, so that the haulage line tends to lift the front of the log from the ground, thus making the log easier to drag. A suitable tree, conveniently located near the landing, is used as a spar tree. The top is cut off about 120 to 200 feet from the ground, and the trunk is guyed for rigidity.

The crews for high-lead and ground yarding are practically the same, and much the same kind of work is performed by each crew. Since the front end of the log is elevated in high-lead yarding it does not need to be rounded, as in ground yarding, and a *sniper* is not necessary. A *high climber* cuts off the tops of the spar trees and attaches the blocks, pulleys, and ropes used in high-lead yarding. He, and not the *rigging slinger* as is the case in ground yarding, is also in charge of rigging up. He is one of the highest-paid and most highly skilled of all woods workers. The *rigging slingers*, *hook tenders*, *chasers*, *chokermen*, *whistle punks*, and *yarder engineers* perform the same tasks in high-lead yarding as in ground yarding.

In overhead yarding two spar trees are used, a head spar and a tail spar, with a cable between the two. Sometimes portable head and tail spars are used instead of trees. A carriage through which the main line passes is supported by the overhead cable and the logs are lifted clear of the ground. There are several methods of overhead yarding, such as the Lidgerwood system, the North Bend system, the MacFarlane skyline method, and modifications of them. In some systems the overhead cable is kept taut and acts only as a track for the carriage of the haulage line; in others, the cable operates as a slack line and is used to elevate the logs as well as to support the carriage on the haulage line.

The crew necessary to carry on overhead yarding is the same as for high-lead yarding and usually includes from 10 to 18 men. The types of work performed are also practically the same as in ground yarding or high-lead yarding.

Whenever it is feasible to do so, the logs are skidded from the stump to a landing at the railroad spur or truck road in one operation. Sometimes this is impossible because of the topography or the great distance between the stump and the landing. In such cases swinging operations are performed. A yarder engine is placed as far as possible from the stump, and the logs are skidded to that point. Another yarder engine is then employed to skid them to the landing. The second haul, referred to as swinging, involves the use of substantially the same equipment and the performance of substantially the same work as ordinary skidding.

Tractor skidding.—Tractor skidding is used extensively in all sections of the country and is tending to displace power skidding. Tractors were used in logging operations prior to 1920 principally as a substitute for animals in the ground skidding of logs. Since 1929, 75- to 80-horsepower Diesel tractors have been introduced and are tending to replace the smaller gasoline tractors, particularly in Pacific coast operations.[2]

When tractors are used to skid logs of ordinary size over fairly even land, the logs are simply hooked by a tong or choker to a cable or chain attached to the tractor and then skidded or dragged to the loading point. Where large logs are hauled over rough ground, the front end of the log is sometimes elevated by a fair-lead arch.

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[2] Ibid., pp. 14, 15.

Tractors are also used to haul bummers or other types of two-wheeled carts used to support the front end of the logs.

Each tractor operates as a unit although any number of tractors may be working on the same logging site. Each is manned by an operator, referred to as a *cat skinner*, and logs are hooked to the tractor by a *chokerman* or *tongs hooker* depending upon the device used. A *swamper* usually works with a tractor crew to clear away brush and to help make a landing for the logs.

Animal skidding.—Animal skidding is still quite common, especially in the South. Horses and mules are used extensively to skid logs by dragging them to the landing. Animals are also used to haul various types of two-wheeled carts such as low-wheeled bummers, which raise the front end of the log as it is moved and bear the weight of the log on the axle. They are also used to haul high-wheeled carts from which the log is suspended beneath the axle, with the rear end of the log dragging on the ground. In the flat country of the South logs are also loaded directly onto four- or eight-wheeled wagons. Where such wagons are used, logs are elevated and loaded by means of a cross haul with horses or mules furnishing the power.

In the Lake States and northern States, runners are substituted for wheels in winter, and skidding and hauling may be carried on throughout the year. Two-runner sleds hauled by horses are used for skidding over ice skid-roads, the forward end of the log resting on the sled, and the rear dragging on the ground. A two-sled bob is frequently used to transport a load of logs for a considerable distance, either to a landing or directly to the sawmill.

Where animals are used for hauling logs or where carts or wagons are used to transport logs to a landing, the work varies somewhat, depending upon the method used. If animals are used for dragging logs along the ground a *teamster* or *snaker* usually adjusts the skidding tongs or chokers and drives the horses or mules. A *swamper* may assist in preparing the logs and making a skidway. Where carts, wagons, or sleds are used, the *teamster* may be assisted by a *loader*. A skidding crew operates under the direct supervision of a *foreman* or *woods boss*, who plans the work and gives assistance where needed.

Other skidding methods.—Other skidding methods are sometimes used, especially in small operations. One method of modified power skidding is to rig up a drum and cable, usually on an old automobile or truck chassis, and to drag the log either along the ground or partially suspended in the air. The truck is anchored to a tree or stump and the cable from the drum passes through a pulley fastened to a nearby tree and thence out to the logs to be yarded. The cable is usually hauled out by hand by the *tongsman*, who fastens the tong to the log and follows it in to unhook it. The operator of the drum is usually known as a *drum man*.

Frequently, logs are decked when received at the landing. Decking, which is similar to loading, involves arranging the logs in piles so that they can be handled more readily when being loaded for transportation to the sawmill.

Loading.

After the logs are collected at the landing, they are loaded on railroad cars or trucks for transportation to their final destination, the sawmill. If water is available, either from a stream or flume, they may be driven to the mill or, if on a lake or tidewater, they are made into booms and towed to the mill.

The most frequently used method of loading logs on railroad cars or trucks is by means of a power loader, known in the forests of the Lake States as a "jammer." A power loader is essentially a derrick with a boom fixed at the bottom and revolving about the base. It may be a mobile device or a stationary device erected at the landing.

Stationary power loaders are most frequently used where logs are yarded by a cable system. The two most important types of stationary loaders are the guy-line system and the boom system. Guy-line loading systems are arranged to utilize the guy lines of a spar tree for supporting loading blocks in position over the rail or truck road. Boom loaders are generally two logs arranged to swing around the base of a spar tree, with the outer ends supported by guy lines.

Sometimes used in connection with cable-yarding, but more often in connection with tractor or animal yarding, are self-propelling power loaders, such as locomotive cranes. Some of these loaders are track-mounted and work from a track adjoining the log cars. Others operate over a movable track which lies on top of the empty cars. After each car is loaded, the loader picks up the track and places it on the car to the rear, thus bridging the cars. The loader, under its own power, then moves back to the next car, and the train is moved forward one car-length. Other loaders are so constructed that the empty car can pass under the loader, which straddles the track. Still others lift the empty car from the rear and place it in front of the loader.

In the case of both mobile and stationary loaders, logs are lifted by tongs attached to a cable hanging from the loader boom or guy lines. Bell tongs, which are placed on the ends of the logs, are frequently used, especially to handle comparatively small logs. A short piece of rope is fastened to each tong so that the *tongs hooker* can return the tong for the next load. Double-pointed tongs, somewhat like giant ice tongs, are also used. One pair of tongs may be used at each end of the log or a single pair near the center, the *loader engineer* skillfully resting one end of the log against the boom.

The occupational titles vary somewhat for persons loading logs from the landing onto railroad cars, trucks, or other vehicles and depend upon the method used in loading. Where a power loader or some form of overhead loading is used, the engine is operated by a *loader engineer*, sometimes referred to as a *loader* or *jammer operator*. A *fireman* fires the boiler, if it is operated by steam, and a *wood buck* cuts firewood for fuel. *Loaders* or *tongsmen* place the tongs or hooks on the logs being loaded, sometimes working under the direction of a *top loader*, who supervises the operation and indicates which logs are to be loaded and in what order.

There is no difference in methods of loading railroad cars and trucks; the only difference is in the size and capacity of the equipment. As a general rule, the largest logs are transported by rail, since the railroad loading equipment is comparatively heavier.

Transportation and unloading.

The next step in the logging of timber is transportation of the logs to the log pond or storage yard of a sawmill. In the northwest lumber region, and to a lesser extent in other regions, the bulk of the timber logged is transported to the sawmill over standard-gauge railroads owned and operated by the logging companies.

Logging railroads differ from common carriers in that the installation is temporary or semipermanent in character. They are usually built by the logging operator and are maintained by a track or section crew. The train crew generally consists of a *locomotive engineer*, a *fireman*, a *brakeman*, and perhaps a *conductor*. In small operations the *brakeman* may also act as a *loader*.

Many operators transport logs direct from the woods to the sawmill by truck. This has been found feasible for distances up to 50 miles. Giant truck and trailer combinations are now in use and can haul loads exceeding 100,000 pounds or 15,000 board feet. Logging trucks in the Northwest are manned by a *truck driver*. In southern operations a *helper* is usually employed also.

Many logs are floated to the mill over tidewaters or over lakes or streams. The logs are assembled at a given point, where a boom or raft is constructed. They are then towed to the sawmill by tugs or launches. Usually a separate *boom crew* is in charge of this method of transportation.

As softwood logs are usually stored in water at the sawmill, they may be unloaded or dumped into a millpond. Because hardwood logs may sink in water, they are generally stored on land. Consequently, they are unloaded from trains or trucks and piled in storage yards at the sawmills. There are several common methods of unloading. The logs may be pushed or rolled from the car. In the latter case, the outside rail is elevated 12 to 16 inches at the dump and the logs roll off when the car stakes are removed or the binder chains are loosened. Even when an elevated rail is used, it is sometimes necessary to use some additional device to push the logs from the car. Sometimes a dump is used which tilts automatically when a portion of the load rolls off. A gill poke, which is a horizontal bar fixed at one end, may be used to push the logs from the car as the train is drawn slowly past the unloading point. Several other methods of unloading logs from cars are in use, including hand manipulation with peaveys or an unloader operating in the same manner as a loader. In some cases the train crew does the unloading; in other cases an *unloader* is employed and stationed at the dump at all times.

Camp and equipment maintenance.

Many logging operations maintain facilities to house the logging crews. Such camps may consist of permanent buildings, usually one-story wooden structures, or they may be of the mobile type mounted on railroad trucks and moved into a new location as the railroad line is completed. Other mobile-type buildings are transported by trucks. A large camp may be supervised by a *camp foreman;* in smaller operations the *woods boss* may supervise the camp. The *head cook* purchases the food supplies and supervises the preparation of meals. He is assisted by a *cookhouse crew*, which, in large camps, generally consists of a *baker*, *second cook*, *dishwasher*, *bed maker*, and other specialized workers. A *wood buck* cuts the firewood for the cookhouse and the bunkhouse. If he uses a dragsaw, he is usually known as a *dragsaw man*. The camp may operate a commissary where the men may purchase tobacco, clothing, and other necessities. The persons employed in the commissary are referred to as *commissary employees*.

Each logging operation of any size, whether or not a camp is maintained, has some employees engaged in maintenance of equipment. Some of the maintenance work is done in a shop at the camp site, or, if the logging operation is near the sawmill, the work may be done by the sawmill maintenance shop. In a large operation the maintenance men are under the direction of a *master mechanic*, and they include such craftsmen as *blacksmiths*, *electricians*, *carpenters*, *car repairmen*, *boilermakers*, *welders*, and *mechanics* who service and repair the tractors, donkey engines, and other mechanical equipment. Of course, not all operations employ all of these maintenance men. In small operations all such work is done by one or two *general mechanics*.

Miscellaneous occupations.

Some logging operations may have other pay-roll titles or occupational classifications not previously mentioned. Some camps employ *barkers* or *rossers* who remove the bark from the logs before they are transported to the mill. For the purpose of forest protection, *brush pilers* are employed in pine areas to pile and burn slashings in order to reduce the danger of fire. *Fire wardens* and *lookouts* are on the pay rolls of some companies to watch for forest fires and organize crews to fight them. Some logging companies employ *laborers* to build and maintain fire trails, roads, and telephone lines. Where animals are used for skidding they may be cared for by *stablemen* or *hostlers*.

Accident Hazards

The dangers of logging employments stem from two sources: First, from the general nature of the logging process, and second, from specific logging occupations. All available information on logging accidents and hazards indicates that these general and occupational hazards combine to make logging one of the most dangerous of all American industries.

The ensuing discussion of hazards in the logging industry includes statistical information on the frequency and severity of accidental injuries and a comparison of logging with other industries in this respect. Subsequent sections outline the relation between the logging processes and the causes of logging injuries. Finally, there is a discussion of the hazards of specific logging occupations and statistical material illustrating the extent of these hazards.

Comprehensive information on injury rates for the logging industry is available for workers of all ages. These rates constitute strong evidence that logging is an extremely hazardous type of work for employees of all ages. Unfortunately, information on accident rates is not available for the young-worker group separately. The conclusions with regard to hazards to young workers have therefore been reached primarily on the basis of evidence of hazards to persons of all ages. This procedure is in keeping with the statement of principles made by the Children's Bureau Advisory Committee on Occupations Hazardous for Minors at its meeting on October 13, 1939, with respect to the meaning of the term "particularly hazardous for the employment of minors." This states that—

> Occupations particularly hazardous or detrimental to the health or well-being of workers in general are also particularly hazardous or detrimental to the health or well-being of workers under 18 * * *.[3]

Frequency and severity of accidents.

No one knows how many men are killed or injured in the Nation's forests during a given period. Unlike the mining industry, of which the United States Bureau of Mines conducts annual surveys of industrial accidents covering 90 percent of the active coal mines in the United States, the logging industry's toll of accidents is not totaled by any one governmental or private agency. Many State industrial-accident commissions require that accidents be reported, but varying requirements as to reporting, differences in the coverage of compensation laws, and variations in the methods of tabulating injuries have made it impossible to combine the data from various States into one total which would represent all the industry's accidents with any degree of accuracy.

According to the most representative statistical measurements available on a national basis, the logging industry has a greater number of injuries in relation to exposure to accident than any of the major industries[4] in the United States except anthracite-coal mining. These measurements show also that logging had a high severity rate and a high fatality frequency rate (table 4). The data reveal an additional fact; namely, that while logging operations in some areas tend to be safer than those in other parts of the country, the frequency and severity rates in the safest areas exceed by far the corresponding rates for manufacturing as a whole.

The annual industrial-injury surveys of the United States Bureau of Labor Statistics for the 3 years 1936–38 present the best available data on Nation-wide injury rates for the logging industry. A more detailed study of lumbering accidents, made by the same agency covering the single year 1939, confirmed the general findings based on the annual surveys. Additional statistical material on the frequency and severity of logging injuries was found in data compiled by the Department of Labor and Industries of the State of Washington, the National Safety Council, and representatives of the logging industry.[5]

Annual industrial-injury surveys by the Bureau of Labor Statistics.—An important measure of the hazards of an industry is the frequency of occurrence of industrial injuries in relation to exposure to injury. This measure is known as the frequency rate—that is, the number of disabling industrial injuries per 1,000,000 man-hours of employment. Data obtained from the annual industrial-injury surveys made by the Bureau of Labor Statistics were the basis for computing such a rate covering the experience of the logging industry for the 3-year period 1936–38. These data were based on reports from 91 to 98 plants each year and include a total of 69,000,000 man-hours of employment for the 3 years. During this period 109 injuries occurred for each million man-hours of employment (table 4).

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[3] Advisory Committee on Occupations Hazardous for Minors, The Child (published by the Children's Bureau), vol. 4, No. 5 (November 1939), pp. 136 and 137.

[4] As used in the accident surveys of the Bureau of Labor Statistics, the Bureau of Mines, and the National Safety Council, the term "injury" means a disabling injury—that is, one arising out of and in the course of employment which results in death, in permanent total or permanent partial disability, or in loss of time on any day other than that on which the accident occurred.

[5] No attempt has been made to make comparisons between injury rates derived from different sources. Appendix B, p. 73, discusses the various factors which affect the degree of comparability of these rates.

The great danger of injury in the logging industry, as compared with that of employments in other fields, is apparent from the fact that the average logging workman's chance of sustaining an injury on his job is nearly seven times as great as that of the workman in manufacturing industries as a whole. According to data compiled from the annual surveys of industrial injuries made by the United States Bureau of Labor Statistics, the frequency rate of disabling injuries for manufacturing as a whole during 1936–38 was 16.18 per million man-hours worked compared with 109.00 for logging during this period. The special 1939 study of lumber-manufacture accidents, made by the Bureau of Labor Statistics, notes that "since 1926, when the Bureau began to compile industrial-injury rates for manufacturing industries, logging has consistently had the highest number of injuries per million employee-hours worked."[6] Logging was first in a ranking of 79 industry classifications for which the Bureau of Labor Statistics gathered data for the 3-year period 1936–38.[7] Its frequency rate of 109.00 also exceeded that of the combined rate for anthracite and bituminous coal mining. On the basis of data from the Bureau of Mines, United States Department of the Interior, the frequency rate of disabling injuries in the coal-mining industry (including both anthracite and bituminous mines) during the 5 years 1933–37 was 87.86. Only anthracite mining exceeded logging in the frequency of industrial injuries, the rate for that branch of coal mining during the 5 years 1933–37 being 118.23. (Table 4.)

Another important measure of hazard used in industrial-injury statistics is the standard severity rate—the number of days lost per 1,000 man-hours of employment. In computing this rate, fatal and permanent injuries are assigned an equivalent of days lost according to a standard scale of time charges. Logging injuries caused a time loss of 21.69 days per thousand man-hours of employment during the 3-year period 1936–38 (table 4). In the ranking of the 79 industry classifications according to industrial-injury rates, logging was first in severity as well as in frequency. Data necessary for the computation of a severity rate for coal-mining are not available; hence, that industry cannot be compared with logging in this respect.

The great disparity in hazards between logging and manufacturing as a whole is reflected in a comparison of the measures of the severity of injuries in both these fields. Table 4 shows that during the 1936–38 period the average number of days lost per thousand employee-hours worked in manufacturing as a whole was 2.01. In the logging industry the severity rate of 21.69 was about 10 times as great during this same period.

Data based on the annual industrial-injury surveys of the Bureau of Labor Statistics for the period 1936–38 indicate also that the intensity of injury is much greater in the logging industry than in most other employments. In logging, the average time loss per permanent-partial disability case, according to the standard scale of time charges, was 1,832.3 days. For all manufacturing such disability resulted in an average time loss of 984.8 days. Temporary total disabilities in logging caused an average time loss of 24.2 days; similar injuries in all manufacturing resulted in an average loss of 19.5 days. (Table 4.)

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[6] Causes and Prevention of Accidents in Lumber Manufacture, 1939, by Max D. Kossoris and Swen Kjaer, p. 663. Monthly Labor Review, vol. 51, No. 3 (September 1940). U. S. Bureau of Labor Statistics, Washington.

[7] In this ranking were 69 manufacturing and 10 nonmanufacturing industry classifications but no mining industries.

The frequency with which fatal accidents occur is another measure of hazard of industrial employments. For the 3 years, 1936–38, the fatality frequency rate—that is, the number of fatal injuries per 1,000,000 man-hours of employment—for logging was 1.32 (table 4). In the risk of fatal injury, too, the logging industry exceeded by far manufacturing as a whole, where the fatality frequency rate was 0.10. Thus the average logging workman's chance of meeting sudden death during the course of his employment was 13 times as great as that of the average workman in manufacturing as a whole. Only workers in the coal-mining industry faced a greater risk of death during the course of their employment, the fatality frequency rate for that industry during the period 1933–37 being 1.63 per million man-hours worked.

Table 4.—*Industrial-injury rates for logging, coal mining, and manufacturing in the United States*

Industry	Frequency rate—all injuries [1]	Severity rate [1]	Fatality frequency rate [1]	Disability distribution per 1,000 injuries			Average number of days lost per injury	
				Fatal and permanent total	Permanent partial	Temporary total	Permanent partial	Temporary total
Logging, 1936–38 [2]	109.00	21.69	1.32	12.5	55.3	932.2	1,832.3	24.2
Coal mining, 1933–37 (bituminous and anthracite combined)	87.86	(3)	1.63	19.7	24.8	955.5	(3)	(3)
Anthracite coal mining, 1933–37	118.23	(3)	1.58	14.2	7.4	978.4	(3)	(3)
Bituminous coal mining, 1933–37	80.17	(3)	1.64	21.7	31.2	947.1	(3)	(3)
Manufacturing, 1936–38 [4]	16.18	2.01	.10	6.6	69.6	923.8	984.8	19.5

[1] The frequency rate is the number of disabling injuries per 1,000,000 man-hours of employment; the severity rate is the number of days lost per 1,000 man-hours of employment; the fatality frequency rate is the number of fatal injuries per 1,000,000 man-hours of employment.

[2] Includes logging camps and logging contractors (not operating sawmills). See appendix B, p. 71.

[3] Data not available.

[4] Includes logging.

Source: Compiled from annual surveys of industrial injuries made by the United States Bureau of Labor Statistics, 1936-38, and from annual surveys of coal-mine injuries made by the United States Bureau of Mines, 1933–37.

Study of lumbering accidents in 1939.—An intensive study of accidents in the logging industry was made by the Bureau of Labor Statistics for the year 1939.[8] The results of this detailed study, which covered 388 logging operations employing nearly 27,000 workers for over 44 million man-hours, confirmed the findings based on the annual industrial-injury surveys by the same agency (appendix B, table I, p. 75). The industrial-injury rates for logging in 1939 were as follows:

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[8] Causes and Prevention of Accidents in Lumber Manufacture, 1939. Monthly Labor Review, Sept. 1940, pp. 663–679.

Frequency rate	105.39
Severity rate	17.95
Fatality frequency rate	1.61

In addition to confirming the findings based on statistics for the 3 years from 1936–38, the 1939 study presented data which made possible, for the first time, a comparison of the degree of accident risk faced by workers in each of the Nation's major lumber-producing areas. The differences in topography, size of timber, and logging methods in the 3 important logging regions are reflected in the disparity between the frequency rates for each of these regions. Whereas, in 1939, the frequency rate for all establishments surveyed was 105.39, it was 109.58 in the western States, 102.32 in the southern States, and 96.67 in the northern States. In terms of severity of accidents, however, the western woods appear to present a greater danger. The severity rate was 21.81 in the western States, 16.60 in the southern States, and 7.06 or only one-third that of the West in the northern States.

Most significant for this study is the fact that in the safest region the rates reflecting the frequency and severity of logging injuries were high in comparison with those for all manufacturing. In 1939 the northern States had the lowest frequency rate of any of the regions in the United States, but this rate was six times as great as that for manufacturing as a whole in the United States during the 1936–38 period. While the severity rate in this area was only one-third that of the West, it was nevertheless more than three times as great as that for manufacturing as a whole for the same 3-year period. (Appendix B, table I, p. 75.)

Other studies.—The industrial-injury surveys of the United States Bureau of Labor Statistics are probably the most comprehensive and reliable material on injuries in the logging industry. However, it was possible to derive measures of the frequency and severity of accidents in logging from other sources also. Some of these measures are not so representative of the industry either because they are based on data obtained in one State or region or because they are based on fewer man-hours of exposure. Although they are not strictly comparable to studies of the Bureau of Labor Statistics because of variations in bases and methods of compilation, they tend in general to confirm the findings of the more comprehensive surveys.

One such study was made by the California Lumbermen's Accident Prevention Association and presented at the sessions of the Lumber Section of the Western Safety Conference in Oakland, Calif., in November 1939. The combined experience of 16 companies, which employed 4,041 woods workers for 6,807,094 man-hours during the year 1938, was the basis for the study. The frequency rate of these companies was 116.5 per million employee-hours worked; the severity rate was 8.81 per thousand employee-hours worked. There were 7 fatal injuries in these 16 establishments during 1938, making the fatality frequency rate 1.03.[9]

Accidents in the logging industry in the State of Washington have been the subject of study by the Department of Labor and Industries of that State. Washington's forests supplied 15.5 percent of the Nation's lumber in 1938, more than that of any other State except Oregon (table 1). In 1937 its woods and mills employed 15 percent of the workers in the lumber and timber products industry.[10] The ruggedness of its forests and the size and density of its timber are characteristic of logging conditions in the Western States.

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[9] Fifth Annual Western Safety Conference, Proceedings of the Lumber Section, California Lumbermen's Accident Prevention Association, Oakland, Calif., November 13–16, 1939, pp. 7, 10, and 11.

According to data for the 5 years 1933–37 logging accidents caused 416 deaths and 48 permanent total disabilities in Washington alone. In addition, 1,937 men suffered permanent partial disability and 15,688 men sustained temporary total disability as a result of accidents arising in the course of their employment in the logging industry.

The Washington workmen's-compensation law requires that employers submit a record of employee-hours worked to the Department of Labor and Industries. In logging, the total employee-hours worked for the 5-year period was 124,536,872. On the basis of this exposure, the frequency rate of logging injuries for the 5 years 1933–37 was 145.25 per million employee-hours worked, and the fatality frequency rate was 3.34.

Statistics of the State of Washington also reflect the hazardous nature of the logging industry in comparison with other fields of employment. As has been stated, the frequency of logging injuries in that State for the period 1933–37 was 145.25 per million employee-hours worked. The frequency rate for all injuries was practically four times as great and the fatality frequency rate more than six times as great as the rates for "all other industries," excluding sawmilling. (Appendix B, table II, p. 75.)

Still another source of information tends to confirm the findings of the Bureau of Labor Statistics. The National Safety Council publishes frequency and severity rates for a number of industries, computed from reports submitted chiefly by its member-companies. In the years 1935–39 the frequency rate for the logging industry was never less than 88.99 injuries per million employee-hours worked. In 1936 and 1937 the frequency rate was over 115. During the same period the frequency rate for all industries ranged from 11.83 to 14.02. The National Safety Council's severity rates for logging injuries varied from 5.53 to 17.05 days lost per thousand man-hours worked in the years 1935–39 as compared with rates of 1.42 to 1.64 for all industries.[11]

These studies lead to the same general conclusions as those drawn from the more comprehensive studies of logging injuries made by the Bureau of Labor Statistics—namely, that the danger of industrial injury is much greater in logging than in most other fields of employment; that such injuries tend to be more severe than those suffered by workers in other industries; and that there is a greater risk of death in logging than in nearly all other employments.

Causes of injury.

The hazards of most industries are closely related to the types of machinery and mechanical equipment used and the manufacturing processes involved. In the logging industry these hazards are intensified by the conditions under which logging operations are conducted. These conditions, when combined with the specific hazards attendant upon many logging occupations, such as the use of hand tools and the handling of heavy materials, result in the heavy toll in deaths and injuries reflected in the injury rates discussed previously.

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[10] Based on data from the Biennial Census of Manufactures: 1937, pt. I, Lumber and Timber Products Not Elsewhere Classified, table 2, p. 502.

[11] Accident Rates in the Woodworking and Lumbering Industries, 1935, pp. 9, 10; 1936, pp. 10, 11; 1937, pp. 11, 12; 1938, pp. 10, 11; 1939, pp. 11, 12. National Safety Council, Inc., Chicago. See appendix B, p. 72, for classifications included.

The most comprehensive data available on causes of logging injuries are contained in the annual reports of the Washington State Department of Labor and Industries. The injury cases shown by cause are, however, restricted to nonfatal compensable cases for which claims have been closed. From the Fifth and Sixth Annual Reports, the Children's Bureau has derived statistics summarizing by cause of injury the nonfatal compensable cases in the logging industry for which claims were closed during the 5-year period 1933–37. In order to facilitate an analysis of these data, they were grouped according to classifications that combined the similar causes of injury. Statistics from the State of Washington on causes of logging injuries represent the experience of the industry in the second most important lumber-producing State and are the only data available from which a detailed analysis of the causes of injury in logging can be made. Hence in the discussion of causes of logging injuries, statistics from the State of Washington play an important part.

The 1939 special study of the United States Bureau of Labor Statistics is also of value in the analysis of logging hazards. Though data contained in this survey cover but 1 year and are available only according to a more general classification of the cause of injury, they present the same general picture as the material from the State of Washington.

One of the outstanding hazards of logging employments is falls of persons, which caused 26 percent of the nonfatal injuries in Washington for the 5-year period 1933–37. Nearly half of these accidents were falls on the same level; the others were falls from different levels. In this latter category falls from logs were most frequent (table 5). The hazard of injury from falls exists largely because of the physical character of the woods. Logging is usually carried on where the terrain is rugged and uneven. Western logging, and to a lesser degree logging in the North, is usually characterized by the necessity for working on steep slopes, thus making footing insecure. *Fallers* are unable to obtain secure footing around large trees located on hillsides and around trees with large roots. Consequently, they often work on springboards a considerable distance from the ground, thus increasing the danger of falling. The fact that most woods workers carry sharp axes or saws makes each fall doubly dangerous. Even the flat, relatively open forests of the South present considerable danger of injury from falls. Rocks, holes, tangled brush, and streams endanger the logging worker. After trees are felled and bucked, workers engaged in skidding and loading operations must climb over huge logs to attach chokers and to place or unhook tongs. Swampers and snipers often must stand on logs to chop away limbs. Top loaders stand on log cars or truck cabs during their work. The train crew climbs up and down on cars and engines. Hilly country, rough terrain, tangled underbrush, protruding root swellings and stumps, rocks, and similar obstacles, all of which are conducive to falls, confront nearly all logging workers during the course of their employment.

Available statistical data indicate the direct relationship between accidents involving falls of persons and the physical character of the woods. In the West logging is conducted in hilly country where there are dense forests composed of large trees. In this area falls of persons caused 20 percent of the injuries reported in the 1939 study, made by the Bureau of Labor Statistics, of accidents in the lumbering industry. In the South and in the northern States, where the terrain is less rugged, the forests considerably less dense, and the timber logged much smaller than in the West, only about 10 percent of the injuries were caused by falls. (Appendix B, table III, p. 76.)

TABLE 5.—*Distribution of nonfatal injuries in the logging industry, by cause and extent of injury; Washington, 1933–37* [1]

Cause of injury	Nonfatal injuries[2]						
	Total		Permanent total[3]	Permanent partial injuries		Temporary total	
	Number	Percent		Number	Percent	Number	Percent
All causes	17,504	100.0	48	1,926	100.0	15,530	100.0
Hand tools	3,753	21.5	1	279	14.5	3,473	22.4
Falling trees, limbs, snags, and objects not otherwise specified	2,466	14.1	12	378	19.6	2,076	13.4
Falls of persons from different levels	2,403	13.7	6	221	11.5	2,176	14.0
Falls from logs	1,800	10.3	1	131	6.8	1,668	10.7
Falls from trains or trucks	204	1.1	1	36	1.9	167	1.1
Other falls from different levels	399	2.3	4	54	2.8	341	2.2
Falls of persons on same level	2,156	12.3	5	119	6.2	2,032	13.1
Caught or struck by cables, chokers, and tongs	1,704	9.7	5	233	12.1	1,466	9.4
Cables, lines or, chains	854	4.9	3	150	7.8	701	4.5
Caught or struck by chokers	456	2.6	2	39	2.0	415	2.7
Loading hooks and tongs	394	2.2	---	44	2.3	350	2.2
Handling materials	1,451	8.3	---	70	3.6	1,381	8.9
Slivers, splinters, devil clubs, and cable strands	663	3.8	---	39	2.0	624	4.0
Other	788	4.5	---	31	1.6	757	4.9
Swinging or rolling logs	1,234	7.0	11	248	12.9	975	6.3
Caught between objects or hit by flying objects	781	4.5	---	139	7.2	642	4.1
All other causes	1,556	8.9	8	239	12.4	1,309	8.4

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[1] Includes logging, operation and maintenance; railroads, logging (operation); shingle-bolt cutting; tie cutting; log trucking. Excludes booming and rafting logs; pulpwood cutting; logging rail and truck road construction and maintenance. See appendix B, p. 72.

[2] This table is based on nonfatal injuries alone because no data showing causes of fatal injuries are available for logging during this period.

[3] Percent not shown because the number of injuries is too small to justify percentage distribution.

Source: Compiled from data published in the Fifth and Sixth Reports of the Department of Labor and Industries, State of Washington, 1937 and 1938.

One accident cause which occurs not only with great frequency but which results in relatively severe injuries is being struck by falling trees, limbs, snags, or other falling objects. Trees sent crashing down by fallers present a great menace to other workers. The noise of skidders or caterpillar tractors in operation may drown the warning shouts of the fallers and a huge tree may fall on nearby workmen. Safe logging practice requires that felling crews be kept far from each other and from bucking crews, but this requirement is not always met. Accidents from this cause sometimes occur because of the failure of fallers to give warning that a tree is about to go down or because fallers misjudge the direction in which the tree is to fall.

However, a large proportion of these accidents result from unpredictable and often unavoidable circumstances inherent in the nature of the logging process. Trees being felled sometimes "kickback," injuring the fallers working at the base. In falling, trees often knock down limbs or other trees and send them flying in unexpected directions. These kill or injure men who are at what they believe to be a safe distance, according to usual standards. Sometimes workers who have no reason at all to believe they are in danger are killed without warning by such "widow-makers." Bark or dead limbs are blown from trees by the wind and frequently injure woods workers despite any precautions that may be taken. Dead, standing trees, known as snags, are often blown over by the wind or fall as the result of being jarred. They are dangerous to fell because of the difficulty of predicting the direction in which they will fall and because of the possibility of the top breaking off before the snag is completely felled.

Statistics of nonfatal injuries occurring in the forests of the State of Washington, given in table 5, show that injuries caused by falling trees, limbs, snags, or other falling objects occur frequently and are severe in character. This single cause was responsible for 14 percent of all nonfatal injuries. That these injuries tended to have serious consequences is apparent from the fact that this cause was responsible for 20 percent of the injuries resulting in permanent partial impairments and 12 of the 48 permanent total disabilities.

The especially severe nature of the injuries resulting from this cause is indicated also by the study of logging injuries in the United States in 1939. According to that study, 20 of the 78 deaths and permanent total disabilities reported were caused by falling trees, limbs, or branches. This cause, though responsible for 11 percent of all injuries, accounted for 24 percent of the days lost from all causes.[12]

Felled trees often roll when they are bucked and endanger the lives of the buckers, whose first safety rule is never to approach a log from the downhill side. Trees felled on hillsides may roll or slide hundreds of feet before coming to a stop. In bucking, logs are cut in lengths of from 10 to 60 feet depending upon the species cut, the use to which they will be put, and the size of the tree felled. When yarded by skyline, high-lead, or other overhead methods and when being loaded, logs tend to swing, thereby endangering many workmen. Logs which have been piled up at the landing and are awaiting loading may roll when jarred by the movement of another log. Workers, such as hook tenders, chasers, loaders, and tongsmen, whose duties require them to work near piled logs may be crushed by them.

According to the 5-year figures for Washington, being caught or struck by swinging or rolling logs caused nonfatal injuries to 1,234 men in that State alone, accounting for 7 percent of the nonfatal injuries due to all causes. The severity of this type of accident is indicated by the fact that in Washington 13 percent of the permanent partial disabilities, though only 6 percent of the temporary total disabilities, resulted from these accidents (table 5). Moving logs caused 8 percent of all injuries, both fatal and nonfatal, according to the 1939 study of the Bureau of Labor Statistics, and accounted for 15 percent of the total days lost.

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[12] Causes and Prevention of Accidents in Lumber Manufacture, 1939. Monthly Labor Review, Sept. 1940, table 2, p. 666.

Although not so outstanding a factor as other types of hazards in the total accident picture, mechanical hazards nevertheless constitute an important source of danger to woods workers. Improvements in logging technology resulting in an increase in mechanization in the industry have tended to increase the danger of accidents from mechanical causes. Log yarding is now done largely by machinery and tractors, and oxen and mules have to a great extent been replaced by complex multidrum engines utilizing high boiler pressures. The use of mechanical equipment for loading logs and power shovels and bulldozers for road and rail construction has been very widespread for some time.

Furthermore, mechanization has greatly increased the tempo of woods work. The logging superintendent of one large company gave clear expression to this fact when he observed, "Things in the woods move about three times as fast as when I was a boy." The faster tempo of work in the woods has also tended to increase the hazards of logging employments.

As a consequence of the increase in mechanized logging, many woods occupations are followed in close proximity to machinery and involve the rigging and handling of cables, lines, or chains, or require that workmen labor on or near trucks, trains, and tractors. Danger of injury from such machines and vehicles is intensified by the fact that they are used under difficult topographical conditions. Cables and riggings must withstand heavy strains, and a snapped cable is capable of inflicting great harm as it whirls in a wide radius through the air. Likewise, a break in a spar tree will cause tree, cables, and block and tackle to come crashing down from great heights.

In the data available, the cause of injury "caught or struck by cables, chokers, and tongs" reflects in part the mechanical hazards of logging employments. This cause was responsible for nearly 10 percent of the nonfatal injuries occurring to workers in Washington's forests, shown in table 5.[13] Cables, chokers, and tongs are most widely used in skidding, swinging, and loading. The generally serious nature of injuries from this clause is evident from the fact that it was responsible for over 12 percent of the permanent partial injuries.

Hand tools are also an important cause of accidents in logging. Loggers' axes and saws must be kept at razor sharpness to be used effectively. Furthermore, they are large, relatively heavy tools, and their use under conditions of insecure footing naturally results in a large number of accidents. Fortunately, hand-tool injuries are not usually so severe as other woods injuries. This is shown by the fact that they were the cause of 21 percent of all the nonfatal injuries occurring in Washington during the 5 years 1933–1937 but of only 14 percent of the injuries resulting in permanent partial disability (table 5). The data presented by the Bureau of Labor Statistics in the 1939 study of lumbering accidents led to the same conclusion, inasmuch as hand-tool accidents accounted for 24 percent of the injuries but only 7 percent of the total days lost. (Appendix B, table III, p. 76.)

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[13] The cause "caught or struck by cables, chokers, and tongs" is not listed separately in the study made by the Bureau of Labor Statistics of logging injuries in the United States in 1939; hence no data regarding this hazard are available from that source.

There are several other factors present in logging occupations which tend to make them hazardous for workers of all ages and especially hazardous for young workers. One factor is that there is constant exposure to the elements. Snow, rain, and sleet increase the possibility of falls and the danger of being struck by moving or falling objects. Nearly all logging jobs require strenuous physical effort, involve the handling of bulky, heavy material, and require the use of sharp hand tools in a hazardous physical environment. The hazards mentioned are inherent in the nature of the work, and though they may be reduced by the wider use of safety devices and more widespread observance of safe practices, there is no immediate prospect that these measures can eliminate the hazards of this industry.

The fact that close supervision of workers is made impossible because of the large area over which workers are spread is another factor. One head bucker may supervise seven or eight falling and bucking crews spread over a half-mile area. Fallers and buckers often work hundreds of feet from fellow workmen and out of sight of foremen or others. Chokermen, who attach chokers to the logs preparatory to skidding, and limbers, who trim branches from felled trees, often work from 1,000 to 2,000 or more feet from the yarder engine or log deck without the supervision necessary to enforce safety rules. Construction crews work in isolated sections and are often spread over wide areas. Thus tendencies to ignore safety rules and adopt "short cuts," regardless of whether such acts constitute unsafe practices, cannot be adequately checked by foremen. Young workers are the ones most in need of close supervision.

A third factor is that the great distance between the working site and the nearest town makes it extremely difficult to provide immediate medical attention for workmen injured in the woods. Some companies make efforts to provide readily available first-aid service by training workers to give emergency treatment to accident victims and by keeping first-aid kits in easily accessible places, but in many other operations this practice has not been adopted. Even if provision is made for first-aid, many logging injuries are of such a nature that emergency treatment of this type is not adequate. The absence of easily available treatment for injured workers contributes to the high severity rate of logging injuries.

It is worthy of note that the causes of most of the accidents in logging are not of the type that can be easily eliminated by mechanical guarding. Hand-tool accidents are difficult to control although some of these accidents could probably be eliminated by placing guards over the cutting edges of the tools while they are being carried to and from work. Falls of persons cannot be reduced by the installation of toeboards, railings, nonskid treads, and other means, as is done in factories. Injuries from falling trees, limbs, snags, or other objects cannot be effectively prevented by mechanical means, although some progress has been made by the use of protective hats and of suitable guards over tractors. Nor can devices be installed to prevent logs from rolling or swinging except under relatively rare circumstances. The nature of the logging operation greatly limits this approach to the problem of accident prevention.

More intensive safety work on the part of the management and more widespread observance of safe practices on the part of logging workers could reduce the number of accidents, but they probably can never be fully eliminated or even drastically curtailed because of the nature of the work. Many logging companies maintain elaborate safety organizations and have made much progress in the elimination of woods accidents, but the frequency and severity rates of injuries in their operations remain high in comparison with other industries. The curtailment of woods accidents depends to a great extent upon the ability of employees to learn to work safely even though the work is performed under hazardous physical conditions. To work with a reasonable degree of safety under the hazards normally found in logging operations requires that workers have not only strength, agility, and endurance but also the maturity, judgment, and experience which will prevent them from committing unsafe acts and which will enable them to determine quickly the proper action when an emergency arises. Boys under the age of 18 years do not, with rare exceptions, have these qualifications. As youths they tend to be reckless, to "take a chance"; as relatively new workers confronted with unfamiliar situations they have not had time to develop the judgment necessary for taking proper action in an emergency; as inexperienced employees they have not been able to accumulate sufficient background to be safe workers.

This is the opinion of employers, workers, and experts in the logging industry and in the safety field. A case history of a logging accident, selected from the 1940 files of the industrial-accident commission of an important lumbering State, relates to an accident occurring to a young boy and illustrates how important is the possession of these qualifications. This case history reveals the manner in which lack of experience, maturity, and judgment led to fatal consequences. It involved a boy 17 years of age who had been in the employ of his father, the owner of the lumber company where he worked. The boy was working during the summer to earn money for school and had been working in his father's logging operation during the past three summer-vacation periods. At the time of the accident he was working as a chaser, removing chokers from logs on the landing at a high-lead operation. A large log, approximately 40 inches in diameter, had been placed on the landing and had been there approximately 15 minutes when another turn of logs came in. The second loader went down to pull slack on the choker, standing on the log as he did so. The victim was in the act of unbuttoning the choker, while standing on the landing with his back to the 40-inch log, when it rolled, crushing him between it and the log from which he was removing the choker. He was killed instantly, and it was necessary to place hooks on the log to move it and permit removal of the body.

The report of the investigation of the industrial-accident commission continues:

> Deceased was only 17 years of age, without a great deal of experience in the woods and testimony indicates he was very anxious to keep up his portion of the job and had a tendency to rush up and unbutton the choker as soon as logs were placed on the landing. It is possible that a more experienced man would have been more cautious prior to the time of going on to a show of this

kind and would have been standing on the log facing the logs above him when he unbuttoned the choker rather than having his back to any danger from above. If deceased had been standing on the log upon which the second loader was standing while pulling slack, he would not have been injured.

Occupational incidence of important accident causes.—The hazards inherent in the logging process endanger nearly all logging workers regardless of occupation. Most of the outstanding logging hazards are not confined to single occupations but are found in many or all of the occupations followed in the woods.

One of the most frequent causes of logging injuries was found to be falls of persons. This hazard endangers the life and limb of all workers in the woods because they all work under the same topographical conditions, which constitute the chief factor in the existence of this source of danger. It is true that the possibility of injury from this cause is greater in some occupations than in others, but it is a fact that falls occur to workers in all occupational groups. By way of illustration, over 60 percent of the permanent partial and temporary total disabilities caused by falls of persons and included in the 1938 and 1939 data on accident claims in the State of Washington occurred to fallers, buckers, chokermen and rigging slingers, and loaders and tongsmen, but a substantial number of injuries to workers in every other occupational group were also caused by falls of persons. (Appendix B, table IV, p. 77.)

Similarly, the majority of hand-tool injuries occurred to buckers and fallers, but workers in nearly every other occupational group suffered some such injuries. Falling trees, limbs, snags, or other falling objects injured chokermen and rigging slingers, hook tenders, chasers, high riggers, teamsters, truck drivers, cat skinners, and workers in nearly every other occupation, although about half of these injuries occurred to fallers and buckers. Swinging or rolling logs caused injuries to buckers, fallers, chokermen and rigging slingers, chasers, hook tenders, loaders, tongsmen, teamsters, truck drivers, and cat skinners, and to other workers.

Cable accidents occurred principally to workers in occupations where cables are frequently handled—to chokermen, rigging slingers, chasers, hook tenders, high riggers, loaders, and tongsmen—but they also caused injuries to men performing other types of work. Accidents resulting from handling materials also occurred to workers in all the occupational categories.

Hazards of specific logging occupations.

The fact that the outstanding logging hazards are present in nearly all occupations and that the injury rates for the industry are outstandingly high raises the presumption that all or nearly all the occupations in it are extremely hazardous for young workers as well as for workers of all ages. The problem, therefore, is not so much to determine what occupations in the logging industry are hazardous for young workers, as to determine what occupations, if any, are not particularly hazardous for the employment of minors under 18 years of age. To make such a determination it is necessary to examine the hazards of specific logging occupations more closely.

The only data available on cause of injury according to occupation were found in unpublished reports of the Department of Labor and Industries of the State of Washington for the 2-year period 1938–39.

These data have been condensed into a classification of accident causes and of occupations adapted to the industry. Although the results cannot be related to exposure to accident, the statistical material derived from the special analysis of figures from the State of Washington and shown in table 6 is of value in illustrating the conclusions presented below. These data are for permanent partial and temporary total injuries only. Data for fatal and permanent total injuries were not available.

Felling and bucking.—The greatest single cause of injury to both fallers and buckers is hand tools. According to the Washington statistics for 1938–39, hand tools caused 37 percent of the injuries to fallers and 50 percent of the injuries to buckers. (Table 6.) Fallers carry and work with axes, saws, and wedges constantly. Buckers employ saws, wedges, and hammers for a great part of their work. The constant use of these sharp tools under conditions of insecure footing will naturally lead to a large number of accidents from this cause. Fortunately, hand-tool injuries are seldom so severe as other types, but they involve the possibility of permanent injury to workmen.

Fallers are in constant danger from falling trees, limbs, snags, or other falling objects, and as was previously indicated, this cause of injury generally results in serious physical impairment or death. Next to hand tools, this is the most frequent cause of accidents to fallers and is probably first as a cause of fatalities and permanent disabilities to workers in this category. Nearly 30 percent of all the permanent partial and temporary total injuries occurring to fallers in Washington resulted from some falling object (table 6). Buckers, too, are endangered when working in or near standing timber. Safe logging practices require that buckers follow felling crews at a safe distance and that snags be cleared before bucking is begun. Despite this accepted requirement, of the 1,403 buckers included in the Washington statistics for 1938–39, 114 were hurt by falling trees, limbs, snags, or other falling objects (appendix B, table IV, p. 77).

Falls of persons injure many fallers and buckers. In order to reach the work site or the next tree to be felled or bucked, workmen must often clamber across felled logs. Worn caulks on boots, slippery logs wet with rain or coated with ice, or a sudden loss of balance have caused falls resulting in serious injuries. Over 20 percent of the injuries sustained by fallers and buckers in Washington as shown in table 6 were caused by falls, nearly half of which were from logs.

Swinging or rolling logs are an outstanding hazard to buckers, who, because of the weight and bulk of the logs, are often killed or maimed by them. Felled logs, lying on an incline or across a stump, rock, or knoll, often roll when the bucking cut is completed. The bucker has to determine the direction of such movement and make sure he is in a safe position upon completion of the cut. Failures in judgment, carelessness, or unforeseen circumstances resulted in 80 injuries to buckers from this cause alone in Washington's forests (appendix B, table IV, p. 77).

The Oregon Logging Safety Code states that "experience is essential for safety in falling and bucking * * *. Weather conditions, common sense, and good judgment govern the safety of fallers and buckers."[14] An indication of the need for these two attributes is the fact that in 1938 and 1939 fallers and buckers suffered 39 percent of the 6,479 permanent partial and temporary total injuries occurring in the logging industry in Washington. Since persons under 18 years have not ordinarily developed these qualities, it may be concluded that this work is too hazardous for them.

TABLE 6.—*Percent distribution of permanent partial and temporary total injuries in specified occupations in the logging industry, by cause of injury; Washington, 1938–39* [1]

Cause of injury	Occupation of injured worker											
	Total	Buckers	Fallers	Choker setters, rigging slingers	Chasers	Hook tenders	High riggers	Loaders, tongsmen	Donkey engineers, firemen	Railroad engineers, firemen, brakemen	Teamsters, truck and cat drivers, steam-shovel and scraper men	All other occupations
All causes	100.0	100.0	100.0	100.0	100.0	100.0	100.0	100.0	100.0	100.0	100.0	100.0
Hand tools	22.2	50.4	37.4	1.6	1.4	5.4	9.0	3.1	4.1	------	2.6	18.1
Falling trees, limbs, snags, and objects n. o. s.[2]	14.1	8.1	29.5	15.5	9.1	14.1	9.6	4.7	8.1	7.6	14.2	11.4
Falls of persons from different levels	14.2	12.7	11.3	16.3	21.9	11.6	16.3	19.9	10.4	20.9	11.9	15.0
Falls from logs	10.9	11.5	8.9	15.4	17.4	9.5	10.9	11.5	5.8	8.6	5.3	10.3
Falls from trains or trucks	1.6	.1	.1	.2	1.8	1.7	------	6.8	1.7	9.5	4.7	1.8
Other falls from different levels	1.7	1.1	2.3	.7	2.7	.4	5.4	1.6	2.9	2.8	1.9	2.9
Falls of persons on same level	10.3	9.6	8.1	12.9	7.8	10.4	10.2	8.6	8.1	16.2	5.1	14.0
Caught or struck by cables, chokers, and tongs	8.7	.3	------	21.2	20.9	20.7	21.1	24.8	7.0	3.8	7.5	3.2
Cables, lines, or chains	4.4	.1	------	10.5	9.1	13.7	19.9	6.1	6.4	3.8	4.0	2.3
Caught or struck by chokers	2.1	.1	------	9.8	9.1	3.7	.6	.5	.6	------	.7	.3
Loading hooks and tongs	2.2	.1	------	.9	2.7	3.3	.6	18.2	------	------	2.8	.6
Handling materials	8.3	5.8	4.9	13.6	8.7	10.4	9.0	5.8	7.6	8.6	10.2	11.2
Slivers, splinters, devil, clubs, and cable strands	3.3	2.8	1.7	7.2	6.9	6.2	4.8	2.0	1.2	1.9	1.6	2.6
Other	5.0	3.0	3.2	6.4	1.8	4.2	4.2	3.8	6.4	6.7	8.6	8.6
Swinging or rolling logs	7.1	5.7	1.7	8.6	16.9	12.0	3.0	17.4	2.9	1.9	12.8	5.0
Caught between objects or hit by flying objects	6.7	4.1	4.0	5.8	8.7	7.5	10.9	9.0	9.9	10.5	11.9	8.7
All other causes	8.4	3.3	3.1	4.5	4.6	7.9	10.9	6.7	41.9	30.5	23.8	13.4

[1] For base figures, see appendix B, table IV, p. 77. The percentage distribution of causes of injuries for certain occupations shown in basic table is not shown here because the number of injuries is too small to justify distribution.
[2] Not otherwise specified.

Skidding and loading.—Employees engaged in skidding logs to the landing and in loading logs for transportation to the log pond or storage yard are exposed to conditions considered equally as hazardous as those confronting fallers and buckers. Power skidding is in general more dangerous than tractor skidding, which, in turn, is more hazardous than skidding with horses or mules.

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[14] Logging Safety Code, effective June 1, 1940, p. 12. State Industrial Accident Commission, Salem, Oreg.

The power-skidding crew, because of the nature of its duties, is involved in a great number of injuries caused by falls of persons. Rigging slingers, chokermen, hook tenders, and chasers work under very difficult footing conditions. Logs are strewn about their work sites; tangled branches, brush, and tree stumps are scattered through the areas in which they operate. In addition these workers must climb over logs and stumps during the course of their work—chokermen to button the chokers around the log and chasers to unbutton them on the landing. Nearly 30 percent of the permanent partial and temporary total disabilities suffered by workers in these occupations in Washington were caused by falls of persons.

Workers in the skidding crew are also constantly subject to falling trees, limbs, or snags. Often they work in the vicinity of felling crews and are injured by falling trees or by flying branches from such trees. Injuries caused by cables, lines, or chains are also common to these occupations. Rigging slingers handle lines and cables during their work; chokermen are in danger of being hit by flying chokers prematurely hauled back by the skidding engine. Chasers are sometimes hit by logs approaching the landing during the yarding operation; often they are caught between logs which roll while awaiting loading on the landing. They may be struck by chokers after these have been unbuttoned and are being hauled back to the chokermen. Indeed, the injuries to chokermen, rigging slingers, and chasers in Washington in 1938 and 1939 included a substantial number of accidents from every major cause. The diversity of causes of injury indicates the dangerous character of these occupations and their unsuitability for the employment of minors.

High riggers or high climbers have what is considered to be the most dangerous job in the woods. They climb to great heights and are especially subject to injury from cable breaks, falls, and kickbacks while topping trees. This relatively small group of workers suffered 166 permanent partial or temporary total injuries in Washington's forest, according to the 1938–39 Washington statistics. Of these, 44 were caused by falls of persons and 33 were caused by being caught or struck by cables, lines, or chains.

Whistle punks and signalmen are endangered by falls, by falling trees, limbs, or snags, and by their proximity to moving lines and cables. In addition, the whistle punk carries a heavy responsibility for the safety of other workers. This fact is now recognized, and although young boys were formerly employed for this work, mature, responsible men are now generally employed.

Engineers and firemen on engines used for yarding and loading are exposed to injury from numerous mechanical hazards and from burns or explosions. They work near moving cables, drums, and other machinery. Their work requires them to stand on platforms which are not equipped with guard rails and from which there is constant danger of falling.

When caterpillar tractors or animals are used for skidding, some of the hazards peculiar to power skidding are eliminated, but they are replaced by somewhat different conditions. In general, the chokermen are confronted with the same hazards as in power skidding except that the possibility of cable injuries is lessened. The same is generally true of chasers and hook tenders, but their work in close proximity to loading operations contains many risks. Teamsters, truck drivers, and cat skinners are in great danger from falling trees, limbs, snags, or other falling objects. Over 14 percent of the permanent partial or temporary total injuries to these workers reported in the Washington statistics for 1938 and 1939 were from this cause. Tractors sometimes turn over on steep inclines, and this has been the cause of many accidents, often of great severity. In animal skidding, the chief danger seems to lie in being crushed by rolling or falling logs.

Workers engaged in loading logs on trucks or trains have highly dangerous jobs. Usually more men are gathered together for loading than for any other operation. There is always the possibility that loaders and tongsmen will be struck by swinging logs as they are being loaded. They also face the possibility of being crushed by logs rolling from the log deck or from cars or trucks. Loading hooks and tongs often strike these workmen, and they are in danger of falling either from logs, as is the case for second loaders, or from trains or the tops of truck cabs where top loaders usually stand. Of the 556 permanent partial or temporary total injuries suffered by loaders and tongsmen in Washington, 29 percent were caused by falls of persons, 25 percent by being caught or struck by cables, chokers, or tongs, and over 17 percent by swinging or rolling logs (table 6).

Workers on the skidding and loading crews, then, are confronted with many hazards during their work. These hazards, diverse in character, include those arising from the use of mechanical equipment, those attributable to the nature of the woods environment, and those due to the size and bulk of the materials handled. The character of these hazards and the great danger of severe injury inherent in them make work in skidding and loading occupations too hazardous for the employment of minors under 18 years of age.

Transportation and unloading.—The hazards to railroad-transportation employees—engineers, firemen, and brakemen—are largely the same as those to any other railroad employees. These are falls from moving trains, the possibility of being crushed or run over by cars, and injuries due to wrecks or derailments. The temporary nature of spur lines of logging railroads and sometimes of the main lines make relatively cheap, quick construction necessary; consequently, operating conditions are less safe than on common carriers.

Falls of persons constituted the commonest cause of injury to railroad engineers, firemen, and brakemen on Washington's logging railroads; well over a third of the 105 permanent partial or temporary total injuries suffered by these workers were from this cause. Being caught between objects or hit by flying objects was also an outstanding cause of injury.

Truck logging and the use of tractors have introduced the possibility of injury due to motor-vehicle accidents, a hazard which is ever present in rugged country where much logging takes place. To reach or leave the work site, trucks must often traverse narrow, tortuous, ungraded roads, often little more than trails. These conditions, together with steep hills and the possibility of the logs shifting or rolling in transit, have made driving or helping on logging trucks an occupation in which there are many dangers. Falls of persons was also a common cause of injury among teamsters, truck drivers, cat skinners, and steam shovel and scraper men. The majority of these injuries were the result of falls from different levels, indicating that these employees are subject to considerable danger from falls from cabs, running boards, or platforms of trucks, tractors, or steam shovels.

Unloading trains or trucks is likewise hazardous. Where logs are stored in a pond, a worker may be standing between the car or truck and the pond as the logs begin to roll and may be crushed or drowned. Sometimes logs are rolled off a truck with the aid of a cant hook, and the worker fails to get in the clear in time to avoid being hit by shifting logs. Sometimes a log will roll off the far side of a car while it is being unloaded and strike a man who has reason to feel that he is not in a danger zone. A considerable proportion of the injuries suffered by truck drivers was caused by swinging or rolling logs.

The hazards of work around motor vehicles or trains, together with the dangers attendant upon the transportation and unloading of huge, heavy logs, make the occupations followed in performing this work particularly hazardous and unsuitable for minors under 18 years of age.

Road and rail construction and maintenance.—Work in a road- or railroad-construction gang or maintenance crew is subject to many hazards. A large part of the job involves clearance of the right-of-way, which, in turn, means felling and clearing all timber along the road's course for a width of from 50 to 120 feet. Nearly all the hazards attendant upon logging are present in this work. Stumps must be pulled or blasted, thus introducing the hazard of dynamite. Bulldozers are then employed to grade the right-of-way; their operation, while not so hazardous as the operation of tractors for skidding logs, cannot safely be entrusted to other than mature, experienced workers. The steel gang handles heavy steel rails, lays down cross ties, and uses heavy hand tools, such as sledges and crowbars, in its work. Fills and cuts must often be made. This may require the moving of thousands of cubic yards of earth which must be loosened by pick work, dynamiting, or other means. The construction of trestles, culverts, or cribbing involves the handling of tall, heavy poles and work at considerable heights from the ground. This work falls in the category of heavy construction, which, as an industry, is characterized by high industrial-injury rates.

Track maintenance involves exposure to some of the same hazards. While work such as tamping of ties and clearing the right-of-way of grass is not especially hazardous, track walkers often help in laying or replacing rails or aid in repairing trestles. These duties require that they work at or near heavy machinery or at considerable heights above the ground. They must patrol trestles and bridges as well as other stretches of track and must be constantly on the alert for trains. Track walkers are under little or no supervision and are entirely dependent on themselves for their safety.

Road- and rail-construction and maintenance work is hazardous even when mature, experienced, completely self-reliant men are employed. One southern logging operator, who kept separate records of logging and railroading accidents and exposure, found that the frequency rate for the latter was about the same as that for the former and that a very substantial proportion of the railroading accidents occurred to the section and construction crews. These employments are particularly hazardous for minors, who characteristically lack the qualities needed to work safely.

Other occupations.—Where logs are water-driven or rafted, boom crews are employed. This work is as dangerous as it is picturesque, particularly because it involves walking over wet logs in deep water or swift streams. Its hazards are so great that none but men of long experience are employed in it. Few young workers possess this experience.

Barkers and rossers, who remove the bark from some kinds of timber, face inuries from hand tools and from rolling logs. This work is usually performed with an ax or other hand tool. The log is given a glancing blow in order that the tool may penetrate only the bark. This glancing action creates the danger of ax injuries to barkers. Because of the dangers present in these jobs, they are not suited for the employment of 16- and 17-year-old workers.

Men, and sometimes women, are engaged in the operation and maintenance of living quarters of logging operations. They work in the logging camp, which in nearly all cases is located some distance from the points where trees are being felled, yarded, and loaded; consequently, camp jobs are free from the dangers of working in the vicinity of these operations. The cook-house crew, dishwashers, bed makers, and wood bucks are engaged in pursuits which have their counterparts in the hotel and other industries. Finally, the places where commissary and office employees usually work are located at considerable distances from the logging site; consequently, these occupations do not appear to be especially hazardous.

Other occupations connected with logging which do not appear to be especially hazardous are those followed in timber-cruising, surveying, and logging-engineering parties. Young workers are sometimes employed in these occupations as assistants to timber cruisers, surveyors, and engineers. The work of such employees is done far from the places where actual logging is conducted, and they are not confronted by the hazards of production work.

Some work is done by logging companies to reduce fire hazards. It consists of clearing fire trails, cleaning up roads, piling brush or slash, constructing and maintaining telephone lines, maintaining fire-fighting equipment, such as water tanks and fire tools, and acting as fire lookout. Occupations of this type appear, on the basis of limited observation in connection with this investigation, to involve relatively little hazard. Indeed, these occupations and timber cruising, surveying, and logging engineering are generally thought to be of definite physical benefit to boys under 18 as well as to older persons because of the healthful outdoor environment in which the work is usually performed and the freedom from many hazards attendant upon work in other logging occupations.

Forest-protection workers, like all other logging employees, are called upon in an emergency to fight forest fires. Fire-fighting is extremely hazardous, but because this is emergency work and not part of the regular duties of these workers, fire-fighting is not considered an integral part of their occupation.

Another occupation sometimes found in logging camps, which is no more hazardous than its counterpart on farms and elsewhere, is that of stableman or hostler engaged in the feeding and care of horses or mules used in skidding or hauling. Draft animals are used in some logging operations in the southern and Lake States, and young workers are sometimes engaged to tend them.

These last four types of occupations connected with logging—that is, those in the operation and maintenance of living quarters, in timber-cruising, surveying, and logging-engineering parties, in forest protection, and in feeding and care of animals used in logging—appear to be the only ones besides office work that are not particularly hazardous for young workers under 18 years of age.

THE SAWMILLING INDUSTRY

The final step in logging is the unloading of the logs and their storage in a log pond or storage yard. From that point on the process of converting trees into lumber is regarded as sawmilling. For the purposes of this report the term "sawmilling" is used to include operations in connection with the conversion of logs into rough lumber and operations in connection with the production of laths, shingles, and cooperage stock.

Sometimes several of these sawmilling operations are carried on in one plant, which also operates a planing mill to produce finished lumber and products such as sash and doors, siding, flooring, and other millwork. The plant may also engage in the manufacture of various wooden articles, such as boxes, furniture, and plywood. In a plant of this type the department in which logs are converted into rough planks, boards, and timbers is referred to in this report as the sawmill. The department in which rough boards are surfaced, dressed, or matched is the planing mill, and the departments manufacturing laths, shingles, or cooperage stock are known respectively as lath mills, shingle mills, and cooperage-stock mills. Departments or plants in which lumber is remanufactured into boxes or other wooden goods are known as box factories, furniture factories, and so forth.

The purpose of this report is to investigate hazards of employment only in sawmills, lath mills, shingle mills, and cooperage-stock mills. The hazards of employment in the remanufacturing departments of sawmilling plants, such as planing mills, box factories, furniture factories, or plywood mills, are not the subject of the present investigation. The hazards of woodworking-machine employments in these mills are the subject of a separate report on woodworking machines.

The process of converting logs into rough or finished lumber begins with moving the logs from the log pond or storage yard to the log deck and then to the head saw, gang saw, and resaws for reduction to cants or boards. Following this, the boards are reduced to uniform width by a type of saw known as an edger and have their ends squared and defective portions removed by another saw called a trimmer. They are then graded, sorted, and stacked for drying either in a yard, where they are air-dried, or in a kiln, where they are dried by heat. After lumber has been dried it may be shipped in its rough state or it may be surfaced or worked in a planing mill operated in connection with the sawmill and then shipped.

The occupations followed in connection with these processes are referred to in this report as sawmilling occupations. Also included in the scope of sawmilling occupations are occupations in lath mills, shingle mills, and cooperage-stock mills. The majority of these mills are operated in connection with sawmills, and in describing the occupations and hazards in lath, shingle, and cooperage-stock mills, they will be so considered. However, the operating methods and equipment in mills specializing in the production of laths, shingles, and cooperage stock differ little, if at all, from those operated in connection with sawmills, and the conclusions reached are intended to apply to both types of establishments.

Whether sold rough or in a surfaced or dressed state, lumber is loaded in cars, boats, or trucks for shipment or is stored in sheds pending shipment. Laths, shingles, and cooperage stock are handled in a similar manner. All the occupations concerned with the packing, loading, storing, and shipping of these products come within the scope of sawmilling occupations. Likewise, employments followed in the maintenance and operation of the plant, as well as in the adjusting and repairing of sawmilling machinery, are included in these occupations.

Present-day sawmilling plants range in size from permanent establishments having production capacities of a million or more board feet of lumber a day and produce a wide variety of lumber and wood products to small portable sawmills which can produce four or five thousand board feet of rough lumber daily. The former are highly mechanized, employ thousands of workers, and ship their products to all parts of the United States and to foreign countries. The latter usually utilize small steam- or gasoline-driven circular saws, generally require the services of only three or four men, and produce mainly for local markets within a radius of 50 to 100 miles.

Many of the high-speed machines and labor-saving devices found in large sawmills are not found in small establishments, but the general methods of rough-lumber manufacture are similar. Small mills often surface lumber but seldom have the machinery for dressing and matching. This is done in plants not owned by the small sawmill operator.

Various kinds and degrees of hazards to which employees are subject during the course of their duties are inherent in the nature of the work performed and the equipment used in these types of mills. The ensuing pages present first a summary of the methods and occupations followed in the production of lumber, laths, shingles, and cooperage stock. Succeeding sections discuss the hazards of these occupations and present statistical data on them.

Methods and Occupations

There are two generally recognized types of sawmills, permanent mills and portable mills. The permanent mills vary greatly in size and production capacity, but in general they are housed in permanent structures, remain on the same site during their lifetime, and convert into lumber the logs transported to them from the logging operation. Portable mills, on the other hand, are small steam- or gasoline-driven units, and can be transported relatively easily to the logging operation supplying the timber. When the supply of timber from one operation is exhausted, they are moved to the site of another supply.

Permanent sawmills.

The degree of specialization of the workers' jobs varies with the size of the sawmill. In large mills the tendency is toward a division of labor and a large number of different occupations. In small mills several occupations are telescoped in such a way that one man performs them. The occupations enumerated below are typical of medium-sized and large sawmills; small permanent mills and portable mills may not include all of them.

Log pond or storage yard.—Where logs are stored in the log pond, as is usual for softwood, they are poled into position to be raised to the log deck by *pondmen* who stand on runways extending over the water, in flatbottomed boats, or on the logs. The *pondman* who poles the log into position in the log slip, from which the log is carried to the log deck on an endless power-driven chain known as the log chain, is frequently known as a *log slipman*. Logs too long for the carriage of the head saw are sometimes cut in two at the pond by a *drag-saw operator*.

Where logs are stored on land, as is the practice for hardwood, *yardmen* move the logs into position for raising to the deck with the aid of cant hooks or mechanical devices. They may be dragged through a small pond or moat by a cable arrangement and raised to the log deck by a log chain. Sometimes they are loaded directly from the railroad car to the log chain or to the log deck. The logs usually are passed through a water spray which washes off dirt and small stones embedded in the bark.

Log deck.—When the logs are received on the log deck they are measured by a *scaler*, who records the log measurement. If they have not already been cut to length suitable for the saw carriage, they are cut in two by a crosscut saw operated by the *scaler* or his assistant, a *log deckman*. A mechanically operated arm pushes the log from the log chain, and it rolls down a slight incline into position for loading on the carriage of the head saw.

Head rig.—The head rig consists of a circular or band saw, known as a head saw, and a log carriage. This mechanism saws the logs into long planks. The log carriage is a flat car upon which the log rests and which moves on rails toward the head saw. Each time the carriage rolls past the saw a slab is sawed from the log, after which the carriage is returned to its original position. A steam or electrically operated "nigger" or "gooseneck" kicks or pulls the log onto the carriage, where mechanical clamps or dogs hold it firmly in place. Two workers known as *doggers*, a *head dogger* and a *second* or *tail dogger*, operate the log-holding mechanism as they ride on the log carriage. In some mills, the dogs are held in place by a compressed-air mechanism operated by the *head sawyer*, thus eliminating the occupation of dogger. The *block setter*, who also rides the carriage, operates the mechanism controlling the thickness of the board being cut. He receives instructions by hand signals from the *head sawyer*. The *head sawyer*, standing in a small enclosure near the saw, operates levers which control the back-and-forth motion of the carriage. He also operates the devices to turn the log after the outside cuts have been made. The log is turned on the carriage as often as necessary to secure boards of desired sizes and of the highest quality. At the rear of the saw, a *tail sawyer* or *head-saw off-bearer* grasps the cut lumber with a shorthandled hook, called a box hook, and starts it moving on live rolls toward the edger. He also clears refuse away from the saw and the guide rolls.

Edger.—Boards cut by the head saw are known as flitches. Their edges are still covered with bark. Live rolls convey the flitches to the edger, which is an automatic-feed machine containing two or more circular ripsaws so mounted that the distance between the saws can be adjusted according to the width of the board being edged. The *edger man* grasps the boards, places them on the feed table, and sets the saws to the necessary width. He then moves the boards to the pressure rolls which feed them into the saws. The edger saws remove the bark-covered edges and leave squared edges. Where exceptionally wide lumber is being cut, the edger is also used to saw boards to the desired width. The *edgerman* may be assisted by an *edger line-up man*, or *edger spotter*, who lines up the boards for the edger. At the rear of the edger, an *edger tailer*, sometimes known as an *edger off-bearer*, separates the good boards from the edgings, places the good boards on a chain conveyor which takes them to the trimmer saw, and throws the edgings on a conveyor belt leading to the slasher saw.

Slasher saws.—The slasher saws cut the edgings and other waste wood conveyed from the head saw, trimmer saw, gang saw, and resaws into smaller lengths to be made into laths or to be ground into fine chips by the hog mill for use as fuel. A *slasher man* operates the controls of the slasher saw and lines up the edgings on a chain conveyor table so that they are fed into the slasher saws. After emerging from the slasher saws, waste wood suitable for making laths is picked out, and the remainder is carried by conveyors, along with other refuse to the hog mill, which grinds it into small chips for use as fuel.

Trimmer saws.—Good boards from the edger are carried to the trimmer saws, a series of circular crosscut saws operated by buttons or levers and designed to square the ends, cut out defective sections of the board, and cut it to the length desired. The trimmer is operated by a *trimmer man*, who sits in a small box or enclosure in front of the saws, where he pushes the buttons or levers that control the various saws, cutting the boards as they pass beneath the saws on a movable chain. A *trimmer loader* or a *trimmer spotter* straightens the lumber on the chain before it reaches the trimmer saws.

Green chain.—After the boards leave the trimmer saws, they drop to the green chain, a conveyor running from the mill out into a shed or into the yard. Standing on the bed of the green chain, a *grader* grades and marks the lumber, and a *tallyman* records the amount of each grade of lumber marked. On either side of the green chain are *green-chain pullers* who pull the lumber from the green chain and place it in piles according to species, grades, thicknesses, and lengths. The boards are then ready to be hauled to the dry kilns or storage yard.

Gang saw and resaw.—After the head saw has cut a number of flitches from the log, a square or rectangular piece remains. This large timber, known as a cant, is suitable for use in construction. It may be conveyed to a *butting sawyer*, who squares its ends, and then be conveyed to the timber dock for storage or shipment. Other large cants are moved to a gang saw, a series of parallel saws with a vertical reciprocal motion, where they are cut into 1- or 2-inch boards. The gang saw is operated by a *gang sawyer*, assisted by a *gang loader* or *line-up man*. A *gang-saw tailer* or *off-bearer* takes the lumber as it comes from the gang saw and starts it to the trimmer and green chain in the same manner as in the case of boards coming directly from the head rig.

Other cants, smaller in size, which are to be cut in half are carried by live rolls to a resaw. The resaw is a band saw, fed by pressure rolls, which rips the cant into two pieces and is operated by a *resaw operator*, assisted by a *resaw line-up man*, who lines up the lumber for the *operator*. A *resaw tailer* or *off-bearer* takes the pieces from the rear of the saw and places them on a conveyor for further processing.

Refuse disposal.—A great deal of refuse material must be disposed of during the operation of a sawmill. If the mill generates its own light and power, this refuse, consisting of sawdust, bark, and unusual pieces of wood is burned in the boiler; otherwise, it may be burned in large refuse burners. Refuse from the slasher saws, as well as from the head rig, edger, trimmer, gang saw, and resaws, is collected by means of a continuous conveyor system and taken to the hog mill. A *hog feeder* stands on a small platform and feeds the material into the hog mill. *Clean-up men* work throughout the mill sweeping sawdust and other refuse into the refuse conveyors.

Yard and dry kiln.—After lumber has been graded and sorted on the green chain, it is ready for the drying process. The green lumber may be air-dried in the green-lumber yard or kiln-dried.

After the boards have been removed from the green chain and sorted according to grade, length, and thickness, they are moved to the green-lumber yard or dry kilns on wheeled vehicles pushed by hand or pulled by motor "jitneys"; by surface carriers, such as the Ross carrier, which straddles a pile of lumber, picks it up, and carries it away; by overhead cranes; or by an overhead monorail system. These devices are manned by a *jitney driver*, *trucker*, *crane operator*, and *monorail operator*, respectively. A ground man, called a *spotter*, assists the *crane* or *monorail operator*.

A mechanical lumber stacker is often used to lift the lumber to the top of the pile, where the *stacker* arranges it. If lumber is stacked by hand, one *stacker* on the ground lifts each board up to another *stacker* working on the pile. *Stackers* are sometimes known as *lumber handlers*.

Lumber intended for kiln drying is restacked on small trucks, and these are moved into the kiln. One common type of stacking machine tilts the pile so that the boards slide from the pile onto the dry kiln truck. A *machine stacker* operates the stacking machine and *stackers* arrange the boards in piles and place wood battens between the courses to assure circulation of air. A *kiln operator* is in charge of the dry kiln.

After the lumber has finished drying, the trucks are removed from the kiln and unloaded by *unloaders* or *unstackers*. It is again made into piles of equal grade and length and is now ready for shipment, for planing and further manufacture, or for storage in the warehouse or dry-lumber yard.

Employees engaged in the final shipping of lumber include *car loaders*, *order men*, *tallymen*, and *shipping clerks*. Their duties vary considerably from mill to mill and are determined largely by the mill's size; all, however, assist in the handling of lumber in one way or another.

Lath mill.—Laths are made from waste material from the edging machine after this material has gone through the slasher saw and has been cut into approximately 4-foot lengths. A *stock picker* selects the pieces suitable for lath making from the conveyer carrying refuse from the slasher saw to the hog mill. A *bolterman* puts the usable slabs through a bolter machine, which is a small gang ripsaw. A *bolter off-bearer* takes this stock and carries it to the *lath-feeder*, who feeds the bolts to the lath machine. *Lath tiers* tie the laths into bundles and trim them to exact length on an equalizer or double-arbor saw. Sometimes *graders* are employed to grade the stock before it is bundled.

Shingle mill.—Some shingle mills are operated in connection with sawmills or other woodworking establishments; others comprise entire plants which produce nothing but shingles. In both cases the operations involved in shingle manufacture are the same.

For use in making shingles, logs are cut into lengths of 16, 18, or 24 inches. These are known as bolts. Occasionally, shingle bolts are cut and quartered in the woods and delivered to the mill ready to go to the shingle machines. Usually, however, logs are received in standard lengths. If the mill has a log pond, the logs are raised from it to a log deck by a log slip, just as in a sawmill.

Logs are cut into bolts by either a circular cutoff saw or a dragsaw, operated by a *cut-off sawyer*. The bolts are then quartered into blocks of convenient size. This may be done by a special type of circular ripsaw or by a splitter, a machine operating somewhat as a drop hammer, splitting the bolts instead of sawing them. Where the former method is used, a workman known as a *knee bolter* places the bolts on the movable carriage of the circular ripsaw, known as a bolter saw, and, while holding the bolt with his hands, moves the carriage forward with his knees. The saw cuts the bolt in half. In the same manner, he then saws the halves into quarters. A *block man* assists the *knee bolter* by placing the quarters on a conveyor which carries them to the shingle machines. A *block piler* removes them from the conveyor and places them on a block table for the *shingle sawyer*. Where a splitter is used, it is operated by a worker known as a *bolterman*. The bark is removed by axes or by the knee-bolter saw, if one is used for quartering.

A shingle machine slices the shingles from the quartered blocks. There are two types of shingle machines, one with a vertical and the other with a horizontal saw. The vertical saw is the more modern machine and the one in most common use. Shingle machines consist of two circular saws, one which slices the shingle from the quartered block and one which clips off the edges of the shingle cutting it to the proper width and smoothness. The *shingle sawyer* fastens the block on a carriage which shuttles back and forth past the first circular saw cutting off a shingle smoothly at each stroke. A device tilts the carriage in alternate directions after each stroke so that a tapered shingle is produced. The *sawyer* picks up each shingle as it comes from the saw and places it on a "springboard" with the butt held firmly against a guide which is at right angles to a second circular saw. He then presses down the "springboard" so that the saw cuts through the overhanging edge of the shingle, leaving a smooth, clipped edge. He then turns the shingle over and clips off the other edge by repeating the process. The *sawyer* must work rapidly to keep up with the production of the shingle machine, which is geared to slice 30 to 40 shingles a minute from the block.

In addition, he must watch the block and adjust it periodically in order to produce the highest grade of shingles.

The *shingle sawyer* grades the shingles as he drops them into one of three chutes, which lead to packing bins below. For each *shingle sawyer* there is a *shingle packer*, who picks the shingles from the bins and makes them into bundles, further grading them as they are packed. Where a number of machines are in use, a *tallyman* records the number of bundles produced by each *sawyer* and *packer*.

Where shingles are kiln dried, the loading, unloading, and drying are performed by *loaders*, *unloaders*, and *dry-kiln operators*, as in sawmills.

Cooperage-stock mill.—Cooperage-stock mills vary greatly in size and, consequently, in manufacturing methods and occupational classifications. The following discussion of manufacturing methods is based chiefly on the methods and occupations commonly followed in a medium-sized plant. Logs are received and stored in a log pond or in a dry-log yard, raised to the log deck, scaled, and cut to the desired length by a dragsaw in the same manner as in a sawmill producing rough lumber. The bark is then removed by peelers, using an ax or a short peeling bar. The peeled log is then split into bolts small enough to handle easily. For this purpose a splitter, essentially a hammer or ram operated by gravity or compressed air, forces a wedge into the bolt. The operator is known as a *splitter*.

Bolts intended for barrel heads are first cut into short lengths for ease in handling. The first cut is frequently made on a knee-bolter saw; then the stock is still further reduced in thickness on a small ripsaw. The operators of these saws are referred to as *knee bolters* and *sawyers*. A *knot-splitter* cuts out sections containing hard knots with a small ax. Then another worker smooths the edges on a wheel jointer, a larg disc with cutting knives on the periphery. Pieces to form the head are then matched for size, planed, and glued or held together with dowel pins so that they form a square block of wood. This form is then placed in a heading turner, which cuts a round head of the desired diameter from the square block. The heads are then bundled until ready for use. In addition to the occupations mentioned, other employees in the heading department include *jointers*, *matchers*, *gluers*, *planer operators* and *off-bearers*, *head-turning machine operators* (also known as *turners*), and *tiers*.

Bolts intended for staves are cut on a ripsaw to the desired thickness. In some mills a small head rig, similar to the head rig in a sawmill, is used for this purpose. The stave material is then cut to length on a double-arbor saw, or equalizer, operated by a *cut-off-saw operator*, or *equalizer operator*. The *stave-saw operator* operates a stave saw, of either the straight or drum type, which cuts the material into stave form. The rough staves go to a vertical wheel jointer where the edges are smoothed, and then they are matched to form a tight joint. Some staves for barrels to contain liquid go through a tongue-and-groove machine after the edges have been jointed, and some have a groove cut at the top and bottom for fastening the heads. This work is performed on a crozer. Staves for some types of barrels are also finished on a sander. Machine operators are generally classified as *operators* and are assisted by *off-bearers*.

Saw fitting.—All but the smallest sawmilling plants maintain a saw-fitting department where saws are sharpened and kept in repair. The sharpening is done by filing the worn sides of the saw teeth with a hand file, an emery wheel, or a saw-filing machine. A *head filer*, assisted by *filers*, does the saw fitting and assists in changing saw blades on the various machines in the plant.

Maintenance department.—The size of the sawmill largely determines the number of maintenance men required. Larger mills employ several *millwrights* who repair machinery, repair and replace belts, and otherwise maintain the mill in operating condition. *Blacksmiths*, *machinists*, *steamfitters*, *electricians*, *welders*, and *carpenters* are included among the workers found in the maintenance department.

Sawmills that generate their own steam and electric current use wood refuse for firing the boilers. The crew necessary to operate the powerhouse consists of *engineers*, *firemen*, and *oilers*, all working under the direction of a *chief engineer*.

Portable sawmills.

Small sawmills which move from one tract of timber to another are common to all parts of the country and are especially prevalent in the South. The equipment of these portable mills is varied. Some operate with steam engines directly belted to the machinery. Others are powered by tractor-type Diesel or gasoline engines. It is not uncommon to find an old truck or automobile motor used as a source of power.

The steps in lumber manufacture in small mills are basically the same as those followed in large plants but on a reduced scale. Operated at a lower speed, the equipment used is crude, often makeshift, and seldom has devices for safeguarding employees.

Log deck and head saw.—Log ponds are seldom used by small portable or semiportable mills. Logs are unloaded, usually from a truck, and are rolled onto the long deck by gravity or by means of a cant hook. A *log turner* rolls the log onto the saw carriage with a cant hook and sets the dogs, which hold the log in place. *Doggers*, usually found in permanent mills, are seldom employed. Sometimes the *sawyer* may assist in setting the dogs. In some mills a *block setter* is employed; in most, the *sawyer* sets the control that determines the thickness of the board to be cut. The *sawyer* operates the mechanism controlling the forward and return motions of the log carriage, as in a permanent mill. Turning the log on the carriage, done mechanically in a permanent mill, is done by hand by the *log turner*, who uses a cant hook. An *off-bearer* stands behind the saw to clear away bark and refuse and handle the clean boards as they are cut by the head saw. Some mills do not have an edger. In this case the *off-bearer* stacks the boards to one side; later they are again run through the head saw, six or eight at a time, and the edges are trimmed off.

Edging machine and trimmer saw.—In most portable mills live rolls are not employed, and boards from the head saw are moved by hand over dead rolls to the edging machine. The *edger man* grasps the boards and feeds them into the machine. The *edger tailer* takes the boards as they come from the machine and stacks them on a small truck or car to be wheeled to the yard or to a saw for trimming. A few portable mills have trimmer saws to cut boards to length, but many portable mills sell all boards in random lengths.

Other occupations.—Lumber from portable mills is seldom planed and practically never artificially dried. It may be sold as green lumber for construction use or may be sold to another mill for kiln drying and planing. *Stackers* or *sorters* may be employed about the mill to pile lumber for air drying or for shipment.

Work in a small portable mill is not so specialized as work in a large permanent mill. There is more interchange of duties, and in the course of a day one person may work as an *off-bearer*, a *stacker*, or perhaps a *sawyer*.

Accident Hazards

The important factor tending to make sawmilling occupations hazardous are the physical conditions of the work site, the necessity for working at or near dangerous power-driven woodworking machinery, and the necessity for handling bulky lumber moving at high speed. While not so dangerous as logging work, the sawmilling industries have very high injury rates in comparison with other industries—rates which raise a presumption that most, if not all, of the occupations in them should be considered especially hazardous.

This section presents data on the frequency and severity of injuries in the sawmilling industries, the causes of sawmilling injuries and their occupational incidence, and the hazards of specific sawmilling occupations. Few industrial-injury data relating specifically to young workers in these industries are available. As was the case in the logging industry, the analyses of hazards of the sawmilling industries for young workers are based chiefly on the data showing the hazards for persons of all ages.

Frequency and severity of accidents.

In frequency of disabling injuries, the sawmilling industries are outranked only by the logging and coal-mining industries. In only three industries—logging, coal mining, and fertilizer—do fatalities occur with greater frequency than in sawmilling. Likewise, the severity of sawmilling injuries is greater than that in any other major manufacturing industry except logging.

Available data from Washington State show that shingle mills have a much higher rate than all other industries not classed as logging or sawmilling and that this rate exceeds even that for sawmilling as a whole. Furthermore, a larger proportion of injuries in shingle mills than in the sawmilling industries as a whole results in permanent partial disabilities. These facts were contained in the same studies from which data on the logging industry were obtained and will be presented in some detail.

No separate statistics for lath mills and cooperage-stock mills were available, but the nature of the processes carried on, the surroundings, and the type of machinery used in these mills were such that there was little reason to believe that their injury rates differed greatly from the rates for sawmills or shingle mills.

Annual industrial-injury surveys by the Bureau of Labor Statistics.—Statistics for the sawmilling industries for the 3 years 1936–38, as presented by the annual surveys of industrial injuries made by the Bureau of Labor Statistics,[1] show an average of 60.11 disabling injuries per million man-hours worked (table 7). This frequency rate was second only to that of the logging industry in the classification of 79 industries according to the standard frequency rate.[2]

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[1] These surveys combine sawmills, veneer mills, shingle mills, cooperage-stock mills, and special-product sawmills not elsewhere classified. They include the salaried personnel (office workers, salesmen, etc.) as well as workers in the mill, but the experience of the latter, not separable from the former, constitutes such a great proportion of the total experience that the rates may safely be considered as reflecting the mill experience, exclusive of office workers and employees of the industry working away from the mill.

The risk of injury run by the average sawmilling worker was nearly four times as great as that faced by an employee in all manufacturing industries. This is apparent from a comparison of the frequency rate for the sawmilling industries (60.11) with the rate for all manufacturing industries (16.18).

The severity rate for the sawmilling industries from 1936 to 1938 was 7.52 days lost per thousand man-hours worked. This rate, too, was nearly four times as great as the rate of 2.01 for all manufacturing. Of the 79 industries ranked in descending order of their severity rates, sawmilling was second only to logging.

The high severity rate for the sawmilling industries was due in part to the fact that the frequency of fatal injuries in sawmilling was high in comparison with that of other industries, although much lower than in the logging industry. During the 3-year period covered by data compiled from the annual industrial-injury surveys of the Bureau of Labor Statistics, there was an average of 0.38 fatalities for every million man-hours worked by sawmilling employees. This rate was nearly four times as high as that for all manufacturing. Among the industries for which fatality frequency rates were compiled, the fatality frequency rate for sawmilling was exceeded only by the rates for the logging and fertilizer industries.

TABLE 7.—*Industrial-injury rates for sawmills and manufacturing in the United States, 1936–38*

Industry	Frequency rate—all injuries	Severity rate	Fatality frequency rate	Disability distribution per 1,000 injuries			Average number of days lost per injury	
				Fatal and permanent total	Permanent partial	Temporary total	Permanent partial	Temporary total
Sawmills [1]	60.11	7.52	0.38	6.5	54.4	939.1	1,227.4	20.2
Manufacturing [2]	16.18	2.01	.10	6.6	69.6	923.8	984.8	19.5

[1] Includes sawmills, veneer mills, shingle mills, cooperage-stock mills, and special-product sawmills not elsewhere classified. See appendix B, p. 71.
[2] Includes sawmills.

Source: Compiled from annual surveys of industrial injuries made by the United States Bureau of Labor Statistics, 1936–38.

Study of lumbering accidents in 1939.—The injury rates for the sawmilling industries in 1939, as presented in a survey made by the Bureau of Labor Statistics of 857 sawmilling plants, although generally lower than those for the 3-year period 1936–38, were still far in excess of those for all manufacturing during that period.[3] The 1939 study showed that the frequency rate for sawmilling was 48.78 injuries per million man-hours worked and the severity rate was 4.70 days lost per thousand man-hours worked.

This study not only showed that western sawmilling plants apparently presented greater hazards to workers than did mills in the southern and northern States but also that in the regions where the injury rates were lowest they were more than double those for manufacturing as a whole. In analyzing sawmilling injuries by region, the 1939 survey of the Bureau of Labor Statistics revealed that the frequency rate for the western States was 55.22; for the southern States, 45.40; and for the northern States, 36.85. The severity rates were as follows: Western States, 5.14; southern States, 4.16; and northern States, 5.13.

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[2] This ranking included 69 manufacturing and 10 nonmanufacturing industry classifications. No mining industries were included.
[3] Factors affecting the degree of comparability of data compiled from the several sources are discussed in appendix B, p. 73.

The higher frequency rate for the West was probably due to the greater size of the lumber handled and the greater speed and size of operations. In severity of inuries the western and northern States ranked about the same. The rate for the South was slightly lower. (Appendix B, table I, p. 75.) But all these rates were greatly in excess of the frequency rate of 16.18 and the severity rate of 2.01 for manufacturing in the country as a whole from 1936 to 1938.

Other studies.—Surveys made by other agencies and groups tend to bear out the findings of the Bureau of Labor Statistics. The study made by the California Lumbermen's Accident Prevention Association, presented at the 1939 Western Safety Conference, showed that 17 western sawmills, which employed a total of 8,993 workers for 17,020,010 man-hours during 1938, had a combined frequency rate of 50.94 and a severity rate of 4.70.[4]

The sawmilling establishments in the State of Washington reported an exposure of 186,892,231 man-hours between 1933 and 1937. The best available industrial-injury statistics for that period, based on compensation claims handled by the State Department of Labor and Industries, show a total of 12,555 injuries. This results in a frequency rate of 67.18 per million employee-hours worked. The data available do not permit the computation of a severity rate, but the serious nature of sawmilling accidents is shown by the fact that the statistics for these 5 years represent 105 deaths, 19 permanent total disabilities, and 1,527 permanent partial disabilities suffered as a result of injuries received by workers while engaged in sawmilling pursuits. (Appendix B, table II, p. 75.)

Statistics for the State of Washington for the 5-year period 1933–37 showed employment in the sawmilling industries to be nearly twice as hazardous, when measured by the frequency rate as all other employments in the State except logging. Shingle mills were more dangerous than sawmills in general. Whereas the frequency rate per million employee-hours worked was 67.18 for all sawmilling industries and only 37.61 for all employments other than logging and sawmilling, it was 76.54 for shingle mills. Likewise, permanent partial disabilities per thousand injuries were 166.6 for shingle mills but only 121.6 for all sawmilling industries and still less (104.2) for all employments other than logging and sawmilling.

The National Safety Council's reports show that sawmills and planing mills rank high among the industries for which it publishes frequency and severity rates. During the 5 years 1935–39, the frequency rate for sawmills and planing mills ranged from 34.38 to 48.42 and was from nearly 3 to 3½ times as great as that for all industries combined. Likewise, the severity rate, ranging from 2.49 to 4.23, was from nearly 2 to more than 2½ times as great as the corresponding rate for all industries.[5]

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[4] Fifth Annual Western Safety Conference, pp. 7–9.

It is apparent from the studies described above that sawmilling industries rank high among hazardous industries and that shingle-mill employments are themselves very hazardous. Separate figures which illustrate the extent of hazard of employment in lath mills and cooperage-stock mills are not available.

The data presented reflect the hazards of sawmilling employments for workers of all ages. For reasons discussed later, these hazards are probably greater when young persons are employed.

Causes of injury.

To afford a basis for determining which sawmilling processes and occupations are hazardous for minors under 18 years of age, the causes of sawmilling injuries were studied. As was previously indicated, the study was made through plant investigations, conferences with safety experts, and analysis of accident statistics for the sawmilling industries.

Mechanical factors were found to be much more important in the creation of hazardous conditions in sawmilling plants than in logging. Sawmilling employments involve work at or near high-speed machinery (belts, pulleys, gears, shafting, conveyor equipment, high-speed saws, moving vehicles, and cranes) all of which contribute to the possibility of accident. Also of great importance in the total accident picture of the sawmilling industries are the facts that lumber is so bulky and heavy as to inflict serious injury if improperly handled, that sawmill lay-out and poor housekeeping make workers subject to the hazards of falls, and that lumber handling results in many injuries and infections from splinters. The continuous noise and vibration caused by heavy machinery also contribute to the danger of accident.

The relative importance of the various causes of sawmilling injuries is indicated by statistical data from several sources. The Department of Labor and Industries of the State of Washington published data on nonfatal injuries in sawmilling plants of that State by cause of injury for the 5 years 1933–37.[6] Other reports from this source contained statistics on the number of permanent partial and temporary total injuries in Washington sawmilling plants for the 2-year period 1938–39 by cause of injury and by occupation of the injured worker. An analysis was made of the causes of injury for the 5 years 1933–37. To facilitate this analysis similar causes of injury were combined into ten major groups. These data are the only recent material available on causes of sawmilling injuries for more than one year. Furthermore, they reflect the experience of a State in which the sawmilling industry is of great importance. They are believed to be representative of the causes of injury in the sawmilling industries.

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[5] Accident Rates in the Woodworking and Lumbering Industries, 1935, pp. 9, 10; 1936, pp. 10, 11; 1937, pp. 11, 12; 1938, pp. 10, 11; 1939, pp. 11, 12. See appendix B, p. 72, for classifications included.

[6] These data include sawmills, planing mills, lath mills, and tie mills (operation and maintenance); masts (with or without machinery); pole yards (independent of logging operations) (n. o. s.); fuel and lumber yards with power-driven machinery (includes teamsters, drivers, and helpers); spars (with or without machinery). Tie mills are essentially small portable sawmills. Planing mills and fuel and lumberyards do not come within the scope of this study, but the data for these establishments are not separable from the statistics as presented. However, by far the greater proportion of the injuries occurred in sawmills, lath mills, and tie mills.

The special study of lumbering accidents in 1939, made by the United States Bureau of Labor Statistics, also presented data on causes of sawmilling injuries. In general, this study leads to conclusions similar to those drawn from the Washington data. However, the classification of accident causes used in the study made by the Bureau of Labor Statistics was considerably less detailed than the one adopted for use in connection with the Washington statistics. Furthermore, these data covered 1 year's experience only whereas the Washington data made available the experience of 5 years. Finally, the Washington reports presented data on cause of injury by occupation for a 2-year period; the study of the Bureau of Labor Statistics contained no similar material. For these reasons, in discussing the causes of sawmilling injuries, chief reliance is placed on material from the State of Washington.

Despite the increasing use of mechanical devices, work in sawmills and planing mills involves a great deal of handling of lumber in nearly all phases of its manufacture. In small or portable mills, the moving of logs from the log deck to the carriage and the turning of the partially sawed logs on the carriage are hand operations. In large mills this is done mechanically. From the log stage to the surfaced board, the wood is reduced considerably in size; but during all stages of the process, lumber remains so large, bulky, and heavy as to cause a great number of injuries due to handling.

Available statistical data show the prevalence of injuries due to falling lumber and handling material. Statistics compiled from data on compensation claims tabulated by the Washington State Department of Labor and Industries for the 5-year period 1933–37 show a total of 10,872 nonfatal injuries in sawmills, lath mills, planing mills, and tie mills. Falling lumber or rolling logs were the cause of 21 out of every 100 nonfatal injuries in the mills of that State (table 8). In the United States as a whole in 1939, 24 percent of all sawmilling injuries were due to being struck by or striking against logs or lumber. (Appendix B, table V, p. 78.) Rolling logs are a hazard particularly to workers on the log deck and to those working about the log chain.

Injuries caused by sudden jerks or strains while the workers are lifting or pulling heavy boards and by slivers and splinters were responsible for 16 percent of the nonfatal injuries in Washington's sawmilling plants.

In sawmills boards are handled by edger men, edger tailers, trimmer loaders, graders, green-chain pullers, resaw operators and tailers, and others in the sawmill; by stock pickers, lath-feeders, off-bearers, and tiers in the lath mill; and by nearly all workers in a cooperage-stock mill. And, more important, lumber is handled in great quantities by dry-kiln and yard workers and employees in storage and shipping departments. The dangers of lumber handling are intensified by the necessity for keeping up with the speed of the mechanical equipment. Only if workers keep up with the tempo of the head rig and other machines can lumber be handled as rapidly as it is produced and confusion and lost motion be prevented.

In lath mills, shingle mills, and cooperage-stock mills many of the hazards arise from lumber handling. Logs are cut into bolts, from which the shingles are sliced. These bolts are often carried manually from the dragsaw to the shingle machines or are lifted by hand to and from conveyor belts running from the splitter or bolter saw to the shingle machines. Shingles are packed in squares and form bulky packages which must be handled by workers storing or loading them. Cooperage stock is generally made from short lengths of logs which are handled by the workers. Laths are first bundled, then lifted and placed on the cradle of an equalizer to be trimmed.

TABLE 8.—*Distribution of nonfatal injuries in sawmilling industries, by cause and extent of injury; Washington, 1933–37* [1]

Cause of injury	Nonfatal injuries [2]						
	Total		Permanent total [3]	Permanent partial		Temporary total	
	Number	Percent		Number	Percent	Number	Percent
All causes	10,872	100.0	17	1,265	100.0	9,590	100.0
Falling lumber or rolling logs	2,330	21.4	------	240	19.0	2,090	21.7
Falling trees, branches, timbers, and lumber	2,197	20.2	------	223	17.7	1,974	20.5
Swinging or rolling logs	133	1.2	------	17	1.3	116	1.2
Falls of persons	2,201	20.3	8	172	13.6	2,021	21.0
On same level	1,335	12.3	3	76	6.0	1,256	13.0
From different levels [4]	866	8.0	5	96	7.6	765	8.0
Handling materials	1,766	16.2	------	71	5.6	1,695	17.7
Slivers, splinters, devil clubs, cable strands, and stepping on nails	618	5.7	------	37	2.9	581	6.1
Other	1,148	10.5	------	34	2.7	1,114	11.6
Machine causes	1,181	10.9	2	373	29.4	806	8.4
Power-driven saws, edgers, planers, etc	558	5.1	------	241	19.0	317	3.3
Kickbacks from power-driven saws	282	2.6	2	24	1.9	256	2.7
Mechanical power transmission	256	2.4	------	71	5.6	185	1.9
Machines not otherwise specified	85	.8	------	37	2.9	48	.5
Other mechanical causes	763	7.0	2	140	11.1	621	6.5
Elevators, cranes, hoists, conveyors, log carriages, and live rolls	437	4.0	1	104	8.3	332	3.5
Trucks, tractors, and other lumber carriers [5]	263	2.4	1	33	2.6	229	2.4
Cables, lines, chains, chokers, tongs, loading hooks	63	.6	------	3	.2	60	.6
Caught between and bumping against objects	1,053	9.7	3	139	11.0	911	9.5
Hand tools	609	5.6	------	35	2.8	574	6.0
Falling objects not otherwise specified	595	5.5	------	53	4.2	542	5.7
Flying objects and other foreign bodies	240	2.2	------	33	2.6	207	2.2
All other causes	134	1.2	2	9	.7	123	1.3

[1] Includes sawmills, planing mills, lath mills, and tie mills (operation and maintenance); masts (with or without machinery); pole yards (independent of logging operations) (n. o. s.); fuel and lumber yards with power-driven machinery (includes teamsters, drivers, and helpers); spars (with or without machinery); retailing of fuel oil by fuel dealers using power-driven machinery (includes drivers and helpers). Excludes shingle mills and lumber inspectors. See appendix B, p. 72.

[2] This table is based on nonfatal injuries alone because no data showing causes of fatal injuries are available for sawmilling industries during this period.

[3] Percent not shown because the number of injuries is too small to justify percentage distribution.

[4] Includes falls from scaffolds, platforms, ladders, trucks, cars, logs, etc.

[5] Excludes falls from trucks and other vehicles.

Source: Compiled from data published in the Fifth and Sixth Reports of the Department of Labor and Industries, State of Washington, 1937 and 1938.

Falls of persons cause many injuries in sawmilling plants. Permanent mills are generally housed in one-story structures, but work is carried on at varying levels within the mill. The portion of the building over the head rig often has a second story where the filing department is located. To get from one part of the mill to another the worker must often step over moving chains, conveyors, or platforms. Lumber is piled from 10 to 30 feet high in yards, sheds, and kilns. Workmen stand on the piles as they are built up. Platforms and runways in nearly all sawmills are made from wooden planking which, owing to the hard usage, wears out quickly and leaves dangerous holes and loose planks if not promptly replaced. Materials waiting to be fed into or taken away from machines may cause a decided tripping hazard. Portable mills are set directly on the ground, which is usually uneven.

All these conditions make falls of persons an outstanding danger of sawmilling employments. Over 20 percent of Washington's nonfatal sawmilling injuries in the years 1933–37 were the result of falls of persons. Falls on the same level accounted for about 6 of every 10 injuries in this general category (table 8). The Bureau of Labor Statistics in its 1939 study found that falls of persons caused 12 percent of all injuries occurring in sawmilling plants in that year. (Appendix B, table V, p. 78.)

The many machines used in sawmilling create hazards resulting in a large proportion of the injuries occurring to sawmilling workers.

High-speed, power-driven saws; moving belts, gears, pulleys, and other power-transmission apparatus; and other machines were responsible for 11 out of every 100 nonfatal injuries in Washington sawmilling plants. Injuries caused by machines tend to be more severe than sawmilling injuries in general. Their greater severity is implicit in the fact that they accounted for 11 percent of the nonfatal injuries of all types in Washington in the 5 years 1933–37, while constituting nearly 30 percent of the permanent partial injuries.

Other mechanical devices, such as elevators, cranes, conveyors, live rolls and log carriages, various types of lumber carriers, and cables, lines, and loading hooks, were the source of 7 percent of Washington's nonfatal sawmilling injuries. That these injuries tended to be severe is indicated by the fact that 11 percent of the permanent partial disabilities stemmed from these causes (table 8).

The three most important injury causes—namely, falling lumber and rolling logs, falls of persons, and handling materials—responsible for 58 percent of Washington's nonfatal sawmilling injuries, are by their nature especially difficult to guard against. Occupations involving considerable exposure to injury from these causes are likely to be especially hazardous for young workers.

Occupational incidence of important accident causes.—The more common causes of injury affected employees in all occupations; in only a few instances was a specific cause of injury found to be associated with only one or a few occupations.

For example, falling lumber or rolling logs, one of the most important causes of the Washington sawmilling injuries, caused injury to workmen in every one of the 17 occupational groups shown for the 2-year period 1938–39. Likewise, falls of persons, handling materials, machines, and being caught between and bumping against objects caused a considerable number of injuries to workers in these occupational groups.

Power-driven saws and edgers caused injury chiefly to sawyers, trimmer operators and spotters, and general laborers. Kickbacks from saws caused injuries chiefly to edger men, edger line-up men, sawyers, and in a few cases to off-bearers. Mechanical lumber carriers inflicted injuries chiefly on teamsters, jitney drivers, and general laborers; few other workers were exposed to danger from these machines.

In general, those causes which accounted for the greatest proportion of injuries were found to have resulted in injury to workmen in most of the occupations. Since these causes are so widespread among sawmilling occupations, there appear to be few, if any, occupations where minors can be employed safely.

Hazards of specific sawmilling occupations.

The widespread occupational incidence of the important causes of sawmilling injuries makes it desirable to determine which specific causes are associated with various occupations and which occupations, if any, are free from the presence of outstanding hazards. Data on the causes of permanent partial and temporary total injuries to sawmilling workers in the State of Washington tabulated for the 2-year period 1938–39, according to occupation, are indicative of the relationship between cause of accident and occupation (table 9). As was stated earlier, these data, together with the data on logging injuries referred to previously, were compiled from unpublished reports of the Department of Labor and Industries of that State and were the only recent statistics available on cause of injury according to occupation. The causes were grouped according to a classification reflecting the important injury causes in sawmilling plants.

Log-pond, storage-yard, and log-deck workers.—Pondmen, boom men, log slipmen, deckmen, and scalers comprise the bulk of the workers in this department of a sawmill. Pondmen and log slipmen face danger of drowning while at work around the pond. The latter also work near the bull chain and face the possibility of injury from moving machinery. Yard workers in mills where logs are stored on land are endangered by rolling logs and falls from logs; they are also exposed to machine hazards, since they work near loaders, overhead cranes, or other machines used to convey the logs to the deck. In portable mills one man often decks the logs, rolls them to the carriage, and turns the log on the carriage. He is exposed to severe injury from rolling or falling logs.

Deckmen and scalers in permanent mills are constantly exposed to rolling-log accidents. The pitched deck provides insecure footing. The mechanical device for causing the log to roll from the bull chain down the deck is often controlled by the scaler, who may cause the log to roll before the deckman is out of the way. Deckmen sometimes operate the large, unguarded, circular cutoff saws. Falls of persons is a hazard confronting workers in all these occupations. According to the Washington data for 1938–39, pondmen and deckmen, boom men, scalers, and log slipmen suffered 62 permanent partial and temporary total injuries; falls of persons and falling and rolling logs caused nearly 50 percent of these injuries. The hazards of work on the log pond, log deck, and in the storage yard and the possibility of severe injuries to workers clearly make occupations in this department unsuitable for young workers.

Head-rig crew.—Numerous hazards confront workers in the head-rig crew. Doggers and block setters, who are part of this crew, ride the carriage. This is extremely hazardous because they face the danger of being thrown from the carriage when it changes its direction. Doggers and block setters are sometimes injured when the device which pushes the logs from the log deck to the carriage throws a log over the head blocks. Sometimes the sawyer fails to reverse the carriage in time, causing it to strike the bumper violently; this usually results in injury to the men on the carriage. The constant motion and high speed of the carriage are likely to induce early fatigue, making these workers more prone to accident than others.

According to table 9, the principal causes of injuries to doggers and blocksetters were power-transmission machines; log carriages, and so forth; being caught between and bumping against objects; falls of persons; falling lumber or rolling logs; and other falling objects.

The sawyer's job is hazardous because of his close proximity to the saw and because of the possibility that he may start the carriage before a log is securely clamped. In such a case the log may roll off against him or the off-bearer or knock a dogger off the carriage. In mills using band saws the saw is at least partially guarded. In some mills using circular saws and especially in portable mills, the sawyer is exposed to contact with the saw. Flying bark, knots, slivers, and stones also imperil this worker.

The possibility of serious injury to workers in the head-rig crew is great when mature, experienced workers are employed. The possibility of injury to young workers in these occupations is no doubt even greater.

Edger men.—Machines are the chief source of injuries to edger men and edger line-up men and kickbacks of lumber are the most important of causes. About 6 of every 10 injuries due to machines were from kickbacks, which result when the stock pinches and climbs the saws before it reaches the back pressure rolls, when a knot or change in grain is struck, or when the stock jams because it is not fed straight. The revolving saw throws the board back with tremendous force in the direction of the worker feeding the machine. Injuries from kickbacks are likely to be fatal or cause permanent disability because of the great force with which a revolving saw propels a board.

Flying slivers, knots, and edgings also endanger these workers. Such injuries are sometimes guarded against by placing heavy wire screens or other guards in front of the saw, but this practice is by no means universal. The hazards of falls of lumber and handling lumber are also present.

Machines accounted for 23 percent of the permanent partial and temporary total injuries occurring to edger men and edger line-up men in the State of Washington according to table 9. Because of the degree of hazard present and because of the need for good judgment, dexterity, and strength for this occupation, it is unsuitable for young workers.

Gang-saw and resaw men.—Men engaged in feeding these saws, which reduce heavy timbers to board thickness, are in danger of coming in contact with the saws while setting or operating them, of kickbacks of lumber, of boards or timbers falling from the live rolls, and of falls while working near moving machinery and con-

TABLE 9.—*Percent distribution of permanent partial and temporary total injuries in specified occupations in the sawmilling industry, by cause of injury; Washington, 1938–39* [1]

Cause of injury	Occupation of injured worker												
	Total	General laborers	Planer operators	Sawyers, all kinds	Lumber pilers	Green-chain men	Off-bearers	Doggers and block setters	Trimmer men and spotters	Edger men and edger line-ups	Truck drivers	Mill-wrights	Other occupations
All causes	100.0	100.0	100.0	100.0	100.0	100.0	100.0	100.0	100.0	100.0	100.0	100.0	100.0
Falling lumber or rolling logs	16.7	16.9	16.3	13.2	24.8	21.5	21.4	9.6	16.8	13.2	14.0	9.1	12.7
Falling trees, branches, timbers, and lumber	15.5	15.4	16.3	11.0	24.6	21.2	19.4	4.8	16.8	12.4	14.0	8.7	9.5
Swinging or rolling logs	1.2	1.5	--------	2.2	.2	.3	2.0	4.8	--------	.8	--------	.4	3.2
Falls of persons	19.7	19.9	15.6	10.3	26.2	24.1	16.9	11.1	8.7	10.1	21.2	22.7	26.5
On same level	11.7	12.7	12.1	7.8	12.6	13.5	14.9	7.9	6.0	6.2	10.6	12.9	12.5
From different levels	8.0	7.2	3.5	2.5	13.6	10.6	2.0	3.2	2.7	3.9	10.6	9.8	14.0
Handling materials	19.4	21.0	19.4	14.4	25.6	26.5	10.4	8.7	17.4	20.9	19.0	14.3	15.2
Slivers, splinters, devil clubs, cable strands, and stepping on nails	5.2	4.9	8.6	2.2	8.0	5.3	2.0	1.6	11.4	6.2	4.5	4.1	2.5
Other	14.2	16.1	10.8	12.2	17.6	21.2	8.4	7.1	6.0	14.7	14.5	10.2	12.7
Machine causes	11.0	6.9	14.3	32.0	1.8	2.9	20.8	15.9	27.5	23.3	1.7	9.8	10.5
Power-driven saws, edgers, planers, etc	5.8	2.7	8.3	24.1	1.0	.5	12.3	--------	18.8	7.0	--------	4.1	4.9
Kickbacks from power-driven saws	3.1	1.8	5.1	6.3	.6	2.4	5.9	4.8	5.4	14.7	--------	1.1	2.9
Mechanical power transmission	1.7	1.9	.3	1.6	.2	--------	2.6	11.1	2.0	1.6	1.7	2.3	2.2
Machines not otherwise specified	.4	.5	.6	--------	--------	--------	--------	--------	1.3	--------	--------	2.3	.5
Other mechanical causes	5.9	6.1	8.0	3.8	3.3	4.5	5.9	15.9	2.1	5.4	12.8	4.9	6.2
Elevators, cranes, hoists, conveyors, log carriages, and live rolls	2.7	1.7	6.1	1.9	1.0	2.7	4.5	14.3	.7	3.9	1.1	2.7	2.2
Trucks, tractors, and other lumber carriers	2.2	3.3	1.6	.3	1.7	1.3	.7	.8	.7	--------	11.7	1.1	2.0
Cables, lines, chains, chokers, tongs, loading hooks	1.0	1.1	.3	1.6	.6	.5	.7	.8	.7	1.5	--------	1.1	2.0
Caught between and bumping against objects	13.5	14.1	16.9	11.6	11.8	14.1	9.1	19.0	14.8	17.8	16.8	12.1	10.3
Hand tools	4.1	4.7	2.2	3.1	1.9	1.6	7.1	6.3	6.0	2.3	3.3	6.8	6.4
Falling objects not otherwise specified	5.2	6.5	3.8	2.2	2.9	2.9	2.6	10.3	2.0	3.9	6.7	10.2	6.6
Flying objects and other foreign bodies	3.1	2.6	2.9	8.1	1.7	1.9	3.9	1.6	3.4	3.1	1.7	6.0	2.2
All other causes	1.4	1.3	.6	1.3	--------	--------	1.9	1.6	1.3	--------	2.8	4.1	3.4

[1] For basic figures, see appendix B, table VI, p. 79. The percentage distribution of causes of injuries for certain occupations shown in basic table is not shown here because the number of injuries is too small to justify distribution.

Source: Unpublished tables of the Department of Labor and Industries, State of Washington, for the 2 years 1938 and 1939.

veyors. Resaw feeders sometimes get their fingers caught in the feed apparatus. Of 319 permanent partial and temporary total injuries occurring to sawyers, 32 percent were due to machine causes. (Table 9.) By far the most important cause was power-driven saws of all types. Another 13 percent of the injuries to sawyers were due to falling lumber or rolling logs and 10 percent to falls of persons.

The chances of injury while operating these saws are great. In addition, injuries resulting from a saw blade tend to be severe. This work is especially unsuitable for persons under 18 years of age.

Slasher and trimmer workers.—Work near slashers and trimmers is hazardous because these saws may cause kickbacks and because the workers may come in contact with the saws. Slasher men and trimmer spotters, engaged in straightening the boards as they approach the saws, are also subject to lumber-handling injuries. In Washington more than one-fourth of the permanent partial and temporary total injuries occurring to trimmer men and trimmer spotters were caused by power-driven saws and other machines; a substantial proportion was caused by handling materials, by falling lumber, and by being caught between objects or bumping against them. Saw injuries occurring to workmen in these occupations tend to result in permanent partial impairment. Young workers should not be exposed to the possibility of suffering a lifelong impairment.

Off-bearers.—There are various types of off-bearers, frequently referred to as "tailers," in a sawmilling plant. Some work behind the head saw. Others remove material from the edgers, gang saws, and resaws as well as from various other machines in the lath mill, shingle mill, and cooperage-stock mill. Off-bearers are exposed to many hazards of which the most important numerically are the danger of injuries from falling lumber, from contact with power-driven machines, from falls, and from handling materials. The outstanding hazards of the various types of off-bearing jobs will be discussed briefly in this report.

Off-bearers working behind the head saw are exposed to mechanical hazards from live rolls, conveyors, and chains. The big slabs cut from the logs may fall off the conveyor and injure these workers. Handling boards and clearing away trash cause lacerations, bruises, and injuries due to slivers. A log improperly held by the dogs may roll loose and strike the off-bearers. Noise and dust are present constantly. Dust, pieces of bark, and wood thrown from the saw often endanger the eyes.

Edger tailers are endangered by lumber handling, by boards moving swiftly down the live rolls after they emerge from the edger, and by moving gears, cogs, and chains.

Gang-saw and resaw tailers are subject to injuries from falling lumber, from handling material, from falls of persons, and from contact with power-driven saws or power-transmission machinery. Off-bearers from the power-driven woodworking machines used in the lath mill, shingle mill, and cooperage-stock mill are endangered by falling lumber. Also present is the possibility of injuries from machines. Off-bearing from many woodworking machines requires that the worker's hand approach a partially or wholly unguarded saw blade, as is often the case in tailing a table ripsaw or a crosscut saw.

Statistical data illustrate the importance of these causes of injury.[7] Of the permanent partial and temporary total injuries occurring to off-bearers in sawmilling plants in the State of Washington during the years 1938 and 1939, 21 percent were caused by falling lumber and rolling logs, 21 percent by machines, and 17 percent by falls of persons (table 9).

The off-bearing occupations in a sawmill are especially hazardous for young workers. Not only are these immature workers subject to the hazards of falling lumber, moving machinery, contact with saw blades, falls of persons, and other hazards which are common to all sawmilling occupations but they are endangered also by their own curiosity and impulsiveness. They are likely to sustain injury while investigating the break-down of a machine, a task which their curiosity may impel them to assume regardless of their responsibility for it. Young workers assigned solely to off-bearing sometimes operate dangerous woodworking machinery in violation of instructions and are injured as a result. The possibility of injury due to errors in judgment, violation of instructions, or the impulsive nature of young workers is great.

Green-chain workers.—The principal cause of injury to green-chain workers (that is, pullers, tallymen, graders, and others) is handling materials. These injuries may result in strains and hernias or may be due to splinters and slivers, which often cause subsequent infection. Falls of persons while lumber is being pulled from the green chain to the racks, falling lumber, and being caught between or bumping against lumber moving on the green chain are also prominent among the causes of injuries occurring to workers in this department. Eighty-six percent of the permanent partial and temporary total injuries to Washington sawmill workers engaged in work on the green chain were from these causes. Graders and tallymen often work at the foot of an incline, located at the head of the green chain. These men are in danger of being struck by boards emerging from the trimmer saws and sliding down the incline.

Yard, shipping, and dry-kiln workers.—Injuries to lumber pilers or stackers, sorters, and general laborers who wheel lumber on trucks around the yard or into dry kilns or who load cars and trucks for shipment are caused largely by falls of lumber; by strains, slivers, and splinters from handling lumber; and by falls of persons. Falls of persons in sawmill yards are often caused by holes or loose planks in runways and platforms. Lumber pilers, working on top of stacks, are in danger of falling off; those at the foot of the stack may be hit by a falling board or caught by a falling stack.

All lumberyard workers are engaged in lifting and moving heavy boards with consequent danger of injuries from lifting heavy weights, from infections from splinters, and from dropping boards during handling. The Washington data on sawmilling injuries for 1938–1939 are conclusive on this point. Lumber pilers (which include mostly yard and shed workers) suffered 12 percent of all permanent partial and temporary total injuries. Over 75 percent of the injuries to these workers were caused by falling lumber, falls of persons, and handling materials.

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[7] These data include some injuries occurring to off-bearers in planing mills because they were not separable from the data on injuries to all off-bearers.

Refuse-disposal workers.—The hogfeeder works in proximity to one of the most dangerous of sawmill machines. Falls into the hogmill are almost always fatal, and the possibility of such falls arises when the hogfeeder attempts to clear a mill which has been jammed. Sometimes the opening leading to the hogmill is not well guarded. The danger of falling into the mill is ever present.

Clean-up men who work in and around the mill are exposed to most of the mill and yard hazards. In addition, the fact that they have no definite place to work which can be known to the other employees makes their jobs even more dangerous.

Saw-filing and equipment-maintenance workers.—These workers are exposed to all the general mill hazards previously discussed because their work requires that they be in the mill during its operation. In addition, they are more likely to be injured while using hand tools or to suffer injury from the special equipment they use such as in saw filing. In Washington, injuries to workers in these occupations were caused chiefly by falls, falling lumber and other objects, handling materials, and by being caught between or bumping against objects. Minors are seldom employed as filers because of the skill required, but they are occasionally employed as assistants. The workers in these occupations are often required to work in the sawmill, either changing saws or repairing equipment. Hence these jobs are not suitable for young workers.

Powerhouse crew.—Engineers and firemen, who constitute the powerhouse crew, work about moving machinery, such as prime movers and generating equipment, and are exposed to the danger of burns and of excessive heat, as well as to possible boiler explosions. For these reasons and because of the responsibility these workers carry for the safety of others, it appears that any occupation in a powerhouse is unsuitable for young and inexperienced workers.

Lath-mill occupations.—Lath mills are nearly always operated in connection with sawmills and are ordinarily housed in the same structure as the sawmill. Lath-mill employees face nearly all the dangers which confront sawmill workers: They work near moving chains, gears, and cogs; they are in danger of falling or being struck by falls of lumber. In addition, bolters and trimmers, the two machines used in lath manufacture, are hazardous because they are generally only partially guarded. They inflict serious injuries if workers come in contact with saw blades or are caught in gears or by shafts. Feeding stock into the machine by hand endangers operators whose fingers may be caught by the pressure rolls. As the working portion of lath trimmers, which are double-arbor saws, cannot be effectively guarded, they endanger workmen. Lath machines sometimes kick back and throw knots and chips.

Shingle-mill occupations.—Work in these mills, which are sometimes operated in connection with sawmills and sometimes run as separate, independent establishments, is generally extremely hazardous. The circular cutoff saw used on the log deck to cut the log into bolts is usually inadequately guarded and offers many opportunities for accidental contact to persons working on the log deck. The knee bolter is even more hazardous; it is unguarded, and the operator, pushing the bolt against the huge saw, may be injured seriously as the result of contact. No really effective guard for a knee bolter seems to be available.

The fingers of the shingle-machine operators come in close contact with saws. Without looking, the operator removes the shingle from the saw which has cut it from the bolt. He places it against a clip saw which trims the sides, inspects it for grade, and throws it down the proper chute, all at a rapid pace. This multiplicity of tasks in connection with fast-moving saws has caused many injuries. Missing fingers are considered a sign of the shingle-makers' trade.

Shingles are generally packed in the basement. Often this is done near the power-transmission apparatus for the shingle mill or for the entire sawmill. Although shingle packing is less hazardous than other work, it is done in close proximity to dangerous machinery.

Cooperage-stock mill occupations.—Usually these mills are operated in connection with sawmills and are subject to the same general hazards. No statistical data are available on the industrial injuries in cooperage-stock mills separately, but the nature of the surroundings and the type of equipment used lead to the assumption that the hazards are comparable to those present in sawmills generally. Bolts for cooperage stock are generally trimmed to length on double-arbor saws. These can be only partially guarded at best and are very dangerous, inasmuch as any contact with the saws will cause serious injury. Stave-sawing machines are generally of the drum-saw variety, and only part of the cutting surface can be guarded. There is great danger of contact with the saw on this machine as in the case of stave and heading jointers and crozers and heading rounders. Offbearing from these machines is also hazardous because of the possibility of contact with the saw and the danger of falls while the worker is carrying material. In the South especially, cooperage-stock mills are usually housed in sheds, with the machines set on the ground. Footing in such mills is poor, and falls of persons in the vicinity of cooperage-stock machines may result in serious accidents.

Other occupations.—Many sawmilling concerns maintain offices in which bookkeepers, stenographers, and clerical workers keep records and accounts. Work in the office of a sawmilling concern is generally little, if any, more hazardous than such employment in other industries. Some sawmilling companies operate commissaries or stores at which their employees trade. Occupations in such stores cannot be considered to have hazards closely associated with the sawmilling industry and do not appear to be particularly hazardous for the employment of workers 16 and 17 years of age.

MINIMUM-AGE STANDARDS IN THE LOGGING AND SAWMILLING INDUSTRIES

Recognition of the danger of injury to workers in the logging and sawmilling industries is widespread. This recognition is reflected in the widespread policy among logging operators and sawmill operators in many areas not to hire workers whom they know to be under 18 years of age. The hazardous nature of logging and sawmilling occupations appears to have been an important factor in convincing experts of the need for an 18-year minimum age for such employments. Minimum-age provisions contained in the now defunct N. R. A. code were the result of recognition by the parties involved of the hazards in these employments.

Although employers and labor and safety engineers recognize the hazards to minors in logging and sawmilling occupations, few States have made legal provision for prohibiting their employment.

The practices of employers regarding the employment of young persons, the opinions of experts on the advisability of such employment, and the provisions of the N. R. A. code are discussed in this section. State legislation governing the employment of minors under 18 years of age in these industries is also reviewed.

Customary Standards

Employment policies.

The policy of the large majority of the employers interviewed during the course of the investigations for this study was not to employ boys under 18 years of age in either woods or sawmill operations. This policy was followed in both the South and the West, the two regions visited during the course of the investigation, especially in the medium-sized and large mills but to a large extent also in small mills. Although there are exceptions to this practice, most firms prefer to avoid employing boys under 18 because of the hazards and arduousness of the jobs.

Employers were practically unanimous in the opinion that "the woods is no place for a boy." They felt that work in the woods requires employees who are mature in judgment and temperament, as well as physically robust, and that few if any boys under 18 years of age meet both these requirements. They stated that upon the safe conduct of each worker depend not only his own safety but that of fellow workmen and that the hazards of the work are such that even safe practices are often no guarantee that accidents will be avoided. Employers stated they considered boys too impetuous to be entrusted with the lives of other workmen and that they are particularly susceptible to injury since, in most jobs in the woods, supervision is superficial and sporadic. Other reasons mentioned by employers for not employing young people were high wage rates which all workers, regardless of age, must be paid, and the availability of a plentiful supply of older, more skilled men.

Operators agreed generally that sawmilling work, also, is too dangerous and too arduous for workers under 18 years of age. The large majority of them stated that they made it a policy not to hire persons under 18 for work in any sawmilling occupation. Their reasons were that the use of heavy, high-speed machines, the fact that the work involves handling of heavy materials, and the availability of skilled, mature workers make the employment of boys inadvisable and unnecessary.

Opinions of experts.

The opinions of safety engineers and others interested in the promotion of safe working conditions are of importance in appraising the hazards of certain occupations as they affect young workers. Among those with expert knowledge of the problems of safety in logging and sawmilling who were consulted during this investigation were safety engineers in the employ of various logging companies, factory inspectors and industrial-accident investigators employed by State labor departments and industrial-accident commissions, and representatives of labor organizations and trade associations.

Among these experts the opinion was almost unanimous that work in most woods occupations is too hazardous for minors under 18 years of age. A very few persons were of the opinion that younger men, if physically robust and of more than average maturity, might safely be employed to work with crews building and maintaining roads and railroads, as whistle punks, or as helpers on tractors. However, the vast majority of those consulted maintained that these pursuits are too hazardous for the average youth. Almost without dissent, these persons stated that the general hazards and dangers inherent in the individual occupations in the woods make inadvisable the employment of minors under 18 years of age in felling, bucking, skidding, loading, in operating railroads, and in unloading logs at the pond.

On the other hand, many of the experts consulted stated that there are some jobs in logging in which youths can be employed without undue exposure to hazard. These include occupations in timber cruising, surveying and logging engineering, and forest protection. Many of these jobs are filled by young workers during summer vacations and afford opportunity to boys of 16 and 17 to enjoy the benefits of work in the healthful environment of the woods without being exposed to the hazards peculiar to other logging occupations.

Most of the experts consulted agreed also that work in the operation and maintenance of logging camps and in the care of animals used in logging is not particularly hazardous.

From these sources also came the opinion that 16- and 17-year-old boys are generally unable to cope with the many hazards existing in work in sawmills without experiencing frequent and severe accidents. A few of the persons consulted stated that husky youths might work on the green chain or in the lumberyard without undue exposure to serious accidents but that even these employments are not suitable for the average boy under 18 years. Several others stated that work in handling dry lumber in the storage yard and in loading lumber, laths, shingles, and cooperage stock for shipment are suitable employments for boys under 18 years of age. Some companies attempt to provide such jobs to young workers, many of them the sons of older employees, during the school vacation, because of the absence of other employment opportunities. However, the majority of the persons consulted believed that the hazards of these employments are such that boys cannot safely be employed.

N. R. A. code provisions.

Industry-wide recognition that work in the logging and sawmilling industries is hazardous is reflected in the provision of the Code of Fair Competition for the Lumber and Timber Products Industry, as approved by the President on August 19, 1933, regarding the employment of minors. Article V (d) of the code indicates recognition of the fact that the hazards of the logging and sawmilling industries are not peculiar to a few occupations only, but are nearly industry-wide in their incidence. This article states:

> No individual under 18 years of age shall be employed except that boys 16 years and over may be employed in the Wooden Package Division and in non-hazardous occupations during school vacations or if there are no wage earners of 18 years or over in their families.[1]

Witnesses appearing at the hearing on the code urged the adoption of the 18-year minimum-age limit for all work under the code. Among them was William Green, President of the American Federation of Labor, who, in urging that 18 be the minimum age for employment in the industry, cited the recommendation made by the Advisory Committee on the Employment of Minors in Hazardous Occupations that employment in lumbering or logging operations, in the loading, unloading, piling, or storing of heavy lumber, and in or about saw and planing mills be prohibited to minors under 18 years of age.[2]

Legal Regulation of the Employment of Minors[3]

Despite the widespread recognition of the hazards of logging and sawmilling occupations by employers, as reflected in their employment policies; by experts, as stated in their opinions given during the course of the investigation; by management, labor, and government, as attested to by the inclusion of a basic 18-year limit in the N. R. A. code without major objection, the States have done little in the way of prohibiting the employment of minors under 18 in these industries.

Logging occupations.

Existing statutes do not safeguard persons under 18 years of age against the hazards of employment in logging occupations, since no State prohibits employment in logging operations of minors up to that age. In fact, in most States children under 16 may legally work in this industry except as their employment may be subject to the

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[1] Code of Fair Competition for the Lumber and Timber Products Industry, art. V (d), p. 25. National Recovery Administration.

[2] Report of Advisory Committee on Employment of Minors in Hazardous Occupations. Monthly Labor Review, vol. 35, No. 6 (December 1932). This committee was appointed in 1932 by the Children's Bureau pursuant to the recommendation of the Committee on Vocational Guidance and Child Labor of the White House Conference on Child Health and Protection which met in Washington, D. C., in 1930.

[3] State laws as of January 1, 1941, and regulations of administrative agencies up to January 1, 1939.

Fair Labor Standards Act. Only 2 States have specific provisions prohibiting such work even for minors under 16 years of age, although in a number of other States such employment of children may be affected by the basic 16-year minimum age set for general employment. The child-labor law of North Carolina specifically prohibits the employment of persons under 16 years of age in, about, or in connection with lumbering and logging operations. Wisconsin also specifically forbids boys under 16 to work in lumbering and logging operations. In only 11 other States[4] are there child-labor laws with a basic minimum age for general employment as high as 16 years. These provisions apply (1) to factory or related employment at any time, or (2) to any gainful occupation during school hours, usually with work in agriculture entirely exempted or with a lower minimum age permitted for agriculture, or (3) to both groups of occupations. There is considerable question as to how effective these provisions are in protecting minors under 16 from the hazards of work in logging operations because of the uncertainty as to whether such operations are covered by the term "factory or related employment" or whether they may be considered to be agricultural and therefore excluded under an agricultural exemption. In 9 of the 11 States the 16-year minimum age applies in factories or related work at any time. Sometimes the 16-year minimum-age standard applies only to work in factories, but sometimes it is broader in coverage. For instance, in South Carolina the 16-year minimum applies only to work in a factory; in Connecticut, to any manufacturing or mechanical industry; in Pennsylvania, to employment in, about, or in connection with any manufacturing and mechanical occupation or process; in Montana, this minimum applies to work in or about any mill, workshop, or factory, or to work wherever machinery is operated. Logging occupations, even if not considered to be factory or related work, may be covered in some of these States by the regulation of employment during school hours. The 16-year minimum-age standard in 10 of these 11 States applies to employment in any occupation during school hours, except that agriculture is exempted or a lower minimum age is permitted in 7 of these 10 States. In only 2 of the 11 States does the 16-year minimum age apply to all employment during school hours, even in agriculture, and also to factory work both during and outside school hours. Obviously, the extent to which these general minimum-age provisions are applied to children employed in logging operations depends upon administrative interpretations or court decisions as to whether these operations are embraced within the coverage of the State law.

In the remaining 35 States, the minimum age for employment is usually 14, and even in some of these States the coverage of logging occupations is doubtful, since these provisions, like the 16-year minimum-age provisions, are sometimes limited to factory or related employment or, if broader in coverage, are often expressly exempted as agricultural work.

A few States place limitations on the employment of young people in some specific logging occupations, applying a higher minimum age for these occupations than for general employment. Thus, in Oregon the general minimum age for employment is 14 years, but no child under 16 may be employed in giving signals to an engineer in a logging operation or in receiving or forwarding such signals. In this State, also, no minor under 18 may act as engineer of or have charge of or operate any logging engine or engines used in logging operations.

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[4] Connecticut, Massachusetts, Montana, New Jersey, New York, Ohio, Pennsylvania, Rhode Island, South Carolina, Utah, West Virginia. (North Carolina and Wisconsin, mentioned above as having specific prohibitions applying to logging occupations, also have a basic minimum age of 16 for general employment.)

In addition to the few specific restrictions on the employment of young persons in particular occupations in this industry, the general restrictions placed on the employment of young persons as hoisting engineers, drivers of motor vehicles, stationary or locomotive engineers, and railroad employees often apply, for these occupations are commonly found in logging operations. Ten States[5] require that operators of hoisting machines be at least 18 years of age. In these 10 States no minor under 18 years of age may be employed as a brakeman, fireman, engineer, conductor, or motorman upon a railroad or at switch tending, gate tending, or track repairing. Michigan and Pennsylvania also require that section hands be at least 18 years of age.

It is apparent, then, that while some States recognize that work in a few logging occupations involves exposure to hazards from which young people especially should be protected, this recognition extends neither to all the occupations nor to all the States. In no State are workers up to 18 years of age protected from all the hazards attendant upon general work in the woods in connection with logging.

Sawmill occupations.

A few States have recognized that work in some sawmill occupations is surrounded by such hazards that minors under 18 should not be permitted to engage in those occupations, but in this case, too, State regulations lag behind public opinion. The Wisconsin law provides that no person under 18 shall engage in any occupation in or about a wood-sawing rig or portable sawmill, thus recognizing the dangers inherent in work in and around small mills, whose limited equipment and temporary nature are not conducive to good safety practices.

Further recognition of the extremely hazardous nature of specific machines in sawmills is indicated by the fact that of the 13 States which have established a basic minimum age of 16 for general employment (that is, a 16-year minimum age for employment in factories at any time or for practically all employment during school hours, or both for factories at any time and for any employment during school hours), 3 States (Michigan, New Jersey, and Pennsylvania) have set a minimum age higher than 16 for certain work found in sawmilling. Michigan and Pennsylvania forbid the employment of minors under 18 years of age on power-driven woodworking machinery in woodworking shops, and New Jersey sets an 18-year minimum age for operating or assisting in operating any power-driven woodworking machinery. Both New Jersey and Pennsylvania, however, provide that bona fide apprentices between 16 and 18 years of age may be so employed provided that such work shall at all times be done under proper supervision. Although only these 4 States have provisions restricting the employment of minors up to the age of 18 in sawmills, 7[6] of the 13 States with a basic 16-year minimum age for employment also specifically prohibit minors under 16 from the operation of certain machines found in sawmills, such as band and circular saws. The prohibition in one of these 7 applies to all power-driven woodworking machinery.

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[5] Arizona, Delaware, Indiana, Maryland, Massachusetts, Michigan, New Jersey, Ohio, Pennsylvania, and Wisconsin.

A number of other States with a minimum-age standard lower than 16 have recognized the extremely hazardous nature of employment in sawmills by fixing the minimum-age standard for certain work therein higher than that set for the general employment of children. Thus 16 of the States which have a basic minimum age of 14 years for general employment and one additional State in which this minimum age is 15 years forbid the employment of minors under 16 in operating or assisting in operating circular saws or band saws, all but 2 of the 17 States applying the prohibition to both types of saws. One other State in which the basic minimum age for employment is 14 years and one State which has no basic minimum age for employment forbid minors under 16 to operate these machines but do not expressly prohibit the minor from "assisting in operating." One of the 17 States mentioned above has extended this higher 16-year minimum age to cover work on crosscut saws and slashers. All these machines are in common use in sawmills. (Table 10.)

TABLE 10.—*States with a basic 14- or 15-year minimum age*[1] *for general employment which have a 16-year minimum for employment on certain types of woodworking machines commonly found in the sawmilling industries, Jan. 1, 1941*

Machine	Type of work	Number of States	States
Circular saws	Operating or assisting in operating.	[2] 17	Alabama, Arizona, Arkansas, California, Colorado, Delaware, Florida, Georgia, Illinois, Indiana, Kentucky, Maryland, Minnesota, New Mexico, North Dakota, Oklahoma, Tennessee.
	Operating	2	Vermont, Wyoming.
Band saws	Operating or assisting in operating.	[2] 15	Alabama, Arizona, Arkansas, California, Colorado, Florida, Georgia, Illinois, Indiana, Kentucky, Maryland, Minnesota, North Dakota, Oklahoma, Tennessee.
	Operating	2	Vermont, Wyoming.
Crosscut saws [3]	Operating or assisting in operating.	1	Maryland.
Slashers [3]	Operating or assisting in operating.	1	Maryland.

[1] California has a basic 15-year minimum age for general employment during school hours. Wyoming has no minimum age, but children legally required to attend school may not be employed during school hours.

[2] In addition to these States, 6 of the 13 States which have a 16-year minimum age for employment in any manufacturing establishment at any time or in any work during school hours, or both, also specifically forbid persons under 16 to be employed at circular and band saws. These States are Massachusetts, New York, North Carolina, Ohio, Rhode Island, and Wisconsin. Three other States, with a basic minimum age of 16 (Michigan, Pennsylvania, and New Jersey) have established an 18-year minimum age for the operation of power-driven woodworking machines, the Michigan and Pennsylvania provisions applying, however, only in woodworking shops.

[3] Wisconsin, which has a 16-year minimum age for work during school hours and a 14-year minimum age for work outside school hours, except in agriculture, has established a 16-year minimum age for operating or assisting in operating or taking material from crosscut saws or slashers.

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[6] Massachusetts, New York, North Carolina, Ohio, Pennsylvania, Rhode Island, and Wisconsin.

Thus for work in sawmills, as in logging operations, no complete ban on employment of minors under 18 has been imposed by the States, and many such minors can be legally employed under the extremely hazardous conditions characteristic of sawmilling work. Those interested in the welfare of youth or concerned with the promotion of industrial safety cannot look to existing State laws for adequate protection of young workers from these hazards.

CONCLUSIONS

1. Because of conditions under which the work is done, employment in logging involves an exceptionally high degree of accident risk.

During the 3-year period from 1936 to 1938, according to data compiled by the United States Bureau of Labor Statistics, the injury frequency rate for the logging industry was 109.00 injuries per million employee-hours worked, the highest of all rates for industries for which adequate statistics are available. The corresponding rate for all manufacturing industries was 16.18. The severity rate of logging injuries was 21.69 days lost per thousand employee-hours worked, compared to a severity rate of 2.01 for all manufacturing industries.

2. Employment in the sawmilling industry likewise involves a high degree of accident risk.

During the 3-year period from 1936 to 1938, according to data compiled by the United States Bureau of Labor Statistics, the injury frequency rate for the sawmilling industry was 60.11 and the severity rate was 7.52. Corresponding rates for all manufacturing were 16.18 and 2.01.

3. The hazards of logging employments stem largely from the nature of the logging process, the dangers of which are increased by conditions of climate and terrain. Workers in most of the occupations followed in the woods are subject to these hazards.

Seventy-eight percent of the nonfatal logging injuries occurring in Washington and tabulated for the 5 years 1933–37 were of a type peculiar to the logging process. They were caused by falls of persons either on the same level or from different levels; falling trees, limbs, snags, and other objects; swinging or rolling logs; hand tools; or being caught or struck by cables, chokers, or tongs. These injuries were widespread among logging occupations.

4. The hazards of sawmilling employments are largely the result of the conditions created by the characteristic plant lay-out, with different working levels; the bulk and weight of the materials handled; and the necessity of working near moving machinery. These hazards are common to practically all sawmilling occupations.

The importance of these hazards is indicated by the fact that about 69 percent of the nonfatal injuries in sawmilling in Washington were due to falling lumber or rolling logs; falls of persons; handling materials; and machine causes. These causes of injury were widespread among the sawmilling occupations.

5. Work in shingle mills, lath mills, and cooperage-stock mills involves a degree of accident risk comparable to that in sawmills.

The injury frequency rate for shingle mills in the State of Washington for the 5-year period 1933-37 exceeded that for sawmills. Shingle-mill injuries also resulted in a greater proportion of permanent partial disabilities than sawmill injuries. No similar data are available for lath mills and cooperage-stock mills, but many of the special machines used in the production of shingles, laths, and cooperage stock are considered to be more hazardous than most sawmill equipment.

6. Certain occupations not directly concerned with the felling of trees, the loading or transporting of logs, or the production of lumber, laths, shingles, or cooperage stock do not appear to be subject to the hazards commonly found in logging. These occupations include

work in offices or in repair or maintenance shops, work in the operation and maintenance of living quarters, work in timber cruising, surveying, or logging engineering parties, work in forest protection, and work in the feeding or care of animals used in logging.

7. The exceptionally high degree of accident risk in work in logging operations, sawmills, shingle mills, lath mills, and cooperage-stock mills is probably greater for young persons than for adults because young persons are characteristically lacking in the experience and caution needed in such work.

8. A large majority of employers have voluntarily adopted an 18-year minimum age for hiring persons for work in the logging and sawmilling industries. Recognition of the hazards of work in those industries has been an important factor in the establishment of this policy.

9. A large majority of the experts—safety engineers, employers, representatives of labor, and others interested in the promotion of safe working conditions—who were consulted during the course of the study expressed the opinion that work in most woods occupations and in practically all sawmilling occupations is too hazardous for 16- and 17-year-old workers.

10. At present no State child-labor laws protect minors by establishing a minimum age of 18 years for general employment in the logging and sawmilling industries.

A few State laws and regulations restrict the employment of minors under 18 in several occupations commonly found in logging operations, such as hoisting engineers, drivers of motor vehicles, stationary or locomotive engineers, and railroad employees.

Only 2 States have express provisions prohibiting the employment of minors under 16 years of age in logging work, the prohibition in one State applying to all minors under 16, and in the other to boys only. In 11 other States there are child-labor laws with a basic minimum age for general employment as high as 16 years, but there is some question as to the application of these provisions to logging. In the remaining States the most general minimum age for employment is 14 years, and even in some of these States the status of logging under the child-labor laws is doubtful.

Recognition of the extremely hazardous character of some sawmilling employments is contained in regulations of 2 States prohibiting the employment of persons under 18 years of age on power-driven machinery in woodworking shops and in the law of one other State prohibiting employment of persons under 18 in operating or assisting in the operation of any power-driven woodworking machinery. In addition, 17 States, with a 14-year minimum age have established a 16-year minimum age for work on specific power-driven woodworking machines commonly found in sawmilling plants.

Appendix A.—Legal Basis for the Investigation

This investigation has been conducted by the Industrial Division of the Children's Bureau pursuant to the regulation entitled "Procedure Governing Determinations of Hazardous Occupations,"[1] issued by the Chief of the Children's Bureau on November 3, 1938, and to the authority conferred by section 3 (l) of the Fair Labor Standards Act of 1938 (act of June 25, 1938, ch. 676, 52 Stat. 1060, U. S. Code, title 29, sec. 201), hereafter referred to as the act. This subsection, which defines "oppressive child labor" as that term is used in the act, provides in part as follows:

> (l) "Oppressive child labor" means a condition of employment under which (1) any employee under the age of 16 years is employed by an employer * * * in any occupation, or (2) any employee between the ages of 16 and 18 years is employed by an employer in any occupation which the Chief of the Children's Bureau in the Department of Labor shall find and by order declare to be particularly hazardous for the employment of children between such ages or detrimental to their health or well-being * * *.

For the purpose of establishing an orderly procedure for determining and declaring occupations to be particularly hazardous for the employment of minors 16 and 17 years of age or detrimental to their health or well-being, the Chief of the Children's Bureau issued the regulation, Procedure Governing Determinations of Hazardous Occupations, the first section of which provided in part as follows:

> SEC. 421.1 *Investigation and conference.*—Preparatory to the making of a finding by the Chief of the Children's Bureau that an occupation or a group of occupations is particularly hazardous for the employment of minors between 16 and 18 years of age or is detrimental to their health or well-being, a study shall be made of information obtained by the Bureau, or submitted to it with respect to the hazardous or detrimental nature of such occupation or occupations. Conferences may be held with representative employers and workers in the industry, experts in industrial health and safety, and others for the purpose of discussing the nature and characteristics of the occupation or occupations under consideration. A public hearing may be held upon reasonable public notice of the time and place thereof whenever such action is deemed by the Chief of the Bureau to be expedient for the purpose of obtaining such evidence with respect to the nature and characteristics of such occupation or group of occupations. A transcript of the proceedings of any such hearing shall be made and filed with the Bureau. A report of facts and conclusions with respect to the hazardous or detrimental nature of the occupation or occupations under consideration shall be prepared upon the basis of such information and evidence.

In accordance with the provisions of the act and the regulation referred to, the Chief of the Children's Bureau instructed the Industrial Division of the Bureau to conduct an investigation with respect to the hazardous or detrimental nature of logging and sawmilling employments, with special reference to young workers, and to consider the problems involved in drafting an order under section 3 (l) of the act.

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[1] Procedure Governing Determinations of Hazardous Occupations, title 29—Labor, chapter IV—Children's Bureau—Child Labor—part 421. Federal Register, vol. 3, p. 2640 DI., November 5, 1938.

Appendix B.—Statistical Supplement

Definitions of logging and sawmilling industries used in injury statistics presented in report.

The statistical data on industrial injuries presented in the report were drawn from various sources; consequently they are based on somewhat varying definitions of the logging and sawmilling industries.

Data from the United States Bureau of Labor Statistics.—The Bureau of Labor Statistics data on logging presented in the report represent, in addition to logging camps and logging contractors, establishments producing the following products:

- Bolts: Handle, heading, shingle, stave, etc.
- Excelsior stock.
- Mine timbers (hewn).
- Poles, hewn round.
- Posts, wooden.
- Pulpwood.
- Railway ties, not sawed.
- Saw logs.
- Spars.
- Timber (product of logging camps).
- Wheel stock.

As pulpwood cutting could not be segregated, it is included in the data even though it is not a subject of investigation in this report. However, it is unlikely that many pulpwood-cutting operations were included either in the annual industrial-injury surveys for 1936–38 or in the special study of lumbering accidents in 1939. This is because the Bureau of Labor Statistics makes no attempt to cover contractors for pulpwood cutting and includes the woods operations of pulp manufacturers only when they are reported separately from the pulp-manufacturing operations.

The data on sawmilling compiled by the Bureau of Labor Statistics are based on statistics for the following classifications:

Sawmills, which include—

- Custom sawmills (if manufacturing and custom sawing are combined).
- Dimension stock, wooden.
- Lath (made in sawmills).
- Lumber, rough.
- Planing mills operated in conjunction with sawmills.
- Railway ties, sawed.
- Sawdust.
- Sawmills (except special-product sawmills).
- Sawmills combined with logging camps or planing mills.
- Veneer stock (flitches), made in sawmills.

Veneer mills, which include—

- Veneer mills.

  - Plywood (made from veneer produced in the same plant).
  - Veneer.

Shingle mills, which include—

  - Shingle mills.
  - Shingles, wooden.

Cooperage-stock mills, which include—

  - Cooperage-stock mills.
  - Cooperage stock (staves, heading, and hoops), not further described.
  - Heading, barrel (cooperage stock).
  - Staves, barrel.

Special-product sawmills not elsewhere classified, which include—

  - Kiln-drying of lumber.
  - Sawmills, special (not elsewhere classified)

Statistics of the National Safety Council.—The industries classified as "lumbering" by the National Safety Council, for which data are presented in this report, include logging operations, timber-treating plants, and sawmills and planing mills combined.

Data from the State of Washington.—The statistics of logging and sawmilling injuries in the State of Washington are based on the industry classifications used by the State Department of Labor and Industries for setting insurance rates for workmen's compensation. The data contained in appendix B, table II, showing the number of injuries, man-hours of exposure, and industrial-injury rates for logging and sawmilling for the 5-year period 1933–37 are based on the classifications in the Washington rate manual, which embrace practically all logging and sawmilling occupations except pulpwood cutting.

For logging these classifications are:

Class 50–1:
  - Logging, operation and maintenance, except pulpwood cutting.
  - Railroads, logging (operation).
  - Shingle-bolt cutting.
  - Tie cutting.
  - Log trucking (includes contract log hauling).

Class 50–2:
  - Booming and rafting logs.

Class 50–4:
  - Logging rail- and truck-road construction and maintenance.

For sawmilling these classifications are:

Class 10–2:
  - Lath mills, planing mills, sawmills, and tie mills (operation and maintenance).
  - Masts (with or without machinery).
  - Pole yards (independent of logging operations) (not otherwise specified).
  - Fuel and lumberyards with power-driven machinery (includes teamsters, drivers, and helpers).
  - Spars (with or without machinery).

Retailing of fuel oil by fuel dealers using power-driven machinery (includes drivers and helpers).

Class 10–3:

Shingle mills (operation and maintenance).

Manufacturing of shakes (hand or machine operations).

Class 10–7:

Lumber inspectors.

The data contained in text tables 5, 6, 8, and 9 and appendix tables IV and VI, however, were based only on class 50–1 for logging and 10–2 for sawmilling. It is believed that the inclusion in class 10–2 of fuel and lumberyards and the retailing of fuel oil neither of which has any relation to sawmilling, did not seriously affect the data since these industries are comparatively small.

Statistics from the Western Safety Conference.—These statistics were published in the Proceedings of the Lumber Section of the Fifth Annual Western Safety Conference, November 13–16, 1939. This source presents separate figures on injuries and exposure in 16 "woods" operations and 17 "plant" operations of western firms but does not define the terms "woods" and "plant." It is assumed that "woods" refers to logging operations proper and "plant" to sawmills, whether or not they are operated in connection with planing mills. Whether pulpwood cutting is included in these data is not known.

Factors affecting the comparability of data from different sources.

No attempt has been made in the report to make comparisons of the injury rates derived from different sources. Such comparisons are not valid because of the existence of the following factors:

Definition of the industry.—The comparability of the injury rates is lessened because the definition of the terms used varies in the studies presented.

Methods of compiling industrial-injury rates.—Although the industrial-injury rates presented in this report have been computed according to the American Standard Method of Compiling Industrial Injury Rates,[1] a slight deviation from this procedure by the Bureau of Labor Statistics in computing the severity rate somewhat lessens the comparability of the data. Because of difficulties in evaluating and assigning a time charge to permanent partial cases where less than full impairment has occurred, the Bureau of Labor Statistics rates every permanent partial case at its full value instead of following the standard method of allowing a percentage of the full time charge for partial loss or partial loss of use of a member.

Size of sample.—The size of the samples on which the studies are based affects the comparability of these data. The annual industrial-injury surveys of the United States Bureau of Labor Statistics for the years 1936–38 were based on 91 to 98 logging operations whose total employment for the 3 years was 69,000,000 man-hours and on 276 to 337 sawmilling plants whose total employment was 209,000,000 man-hours.

The special study of accidents in lumber manufacture in 1939 made by the same agency covered 388 logging establishments that employed nearly 27,000 workers for over 44,000,000 man-hours and 857 sawmills that employed 55,000 workers for nearly 98,000,000 man-hours.

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[1] American Standard Method of Compiling Industrial Injury Rates. Approved by the American Standards Association, April 19, 1937. ASA Z16.1—1937.

The survey of the California Lumbermen's Accident Prevention Association covered only 16 logging companies employing 4,041 workers for 6,807,094 man-hours during 1938 and 17 sawmills which employed 8,993 workers for 17,020,010 man-hours.

The statistics on logging and sawmilling injuries in the State of Washington covered all logging and sawmilling operations subject to the workmen's-compensation act during the 5-year period 1933–37. The total number of employee-hours worked by logging workers during this period was nearly 125,000,000; sawmilling workers were employed for a total of 187,000,000 man-hours.

The data on industrial-injury rates for logging and sawmilling compiled by the National Safety Council were based on reports from 10 to 28 logging firms, 5 to 7 timber-treating plants, and 17 to 47 sawmills and planing mills from 1935 to 1939, inclusive. Man-hours of exposure for logging operations varied from 4,632,000 to 10,074,000, those for timber-treating plants ranged from 4,062,000 to 6,149,000; and those for sawmills and planing mills varied from 12,096,000 to 33,541,000.

Character of the sample.—The character of the sample is an element which affects its comparability to other groups of data. Most of the firms represented in the National Safety Council data, for example, are members of that organization. Their membership indicates an active interest in safety work. Many of these firms maintain safety organizations and conduct campaigns to reduce the toll of accidents in their operations. Industrial-injury data derived from this source should properly be regarded as an index of good safety practices rather than an index reflecting the practices of all logging and sawmilling firms.

The injury rates derived from the industrial-injury surveys of the Bureau of Labor Statistics for the years 1936–38 are Nation-wide in scope and probably reflect more accurately the composite picture for the industry as a whole than do data available from other sources. These data have the advantage also of being based on the experience of the logging and sawmilling industries for a period of 3 years, thus tending to minimize any random or temporary tendencies which may be present in data based on 1 year's experience. The special study of lumbering accidents in 1939, made by the Bureau of Labor Statistics, although based on a larger sample than the data for the years 1936–38, represents only 1 year's experience. On the other hand, data from the Bureau of Labor Statistics are based on voluntary reports and are likely to be biased in the same way as any sample data collected on such a basis.

Industrial-injury rates based on workmen's-compensation statistics, such as the Washington data, reflect the experience of the overwhelming majority of logging and sawmilling firms in the State because all firms come under State workmen's-compensation legislation and are required to report accidents.

TABLE I.—*Industrial-injury rates for logging operations and sawmills, by geographic region; United States, 1939*[1]

Industry and geographic region	Industrial-injury rates				Disability distribution per 1,000 injuries			Number of establishments	Number of employees	Number of man-hours of employment	Total number of days lost
	Frequency rate	Severity rate	Fatality frequency rate	Average number of days lost per injury	Fatal and permanent total	Permanent partial	Temporary total				
Logging[2]	105. 39	17. 95	1. 61	170. 3	17	30	953	388	26, 964	44, 170, 851	792, 961
Western States	109. 58	21. 81	2. 17	199. 0	21	31	948	122	15, 063	23, 974, 128	522, 859
Southern States	102. 32	16. 60	1. 20	162. 2	14	36	950	165	7, 580	13, 369, 437	221, 886
Northern States	96. 67	7. 06	. 44	73. 1	5	16	979	101	4, 321	6, 827, 286	48, 216
Sawmills[3]	48. 78	4. 70	. 23	96. 4	5	46	949	857	54, 841	97, 748, 744	459, 849
Western States	55. 22	5. 14	. 21	93. 1	4	45	951	221	24, 492	43, 300, 259	222, 649
Southern States	45. 40	4. 16	. 28	91. 6	6	40	954	414	23, 680	43, 350, 153	180, 288
Northern States	36. 85	5. 13	. 09	139. 1	3	78	919	222	6, 669	11, 098, 332	56, 912

[1] For States included in each of the three regions, see source.

[2] Includes logging camps and logging contractors (not operating sawmills). See appendix B, p. 71.

[3] Includes sawmills, veneer mills, shingle mills, cooperage-stock mills, and special-product sawmills not elsewhere classified.

Source: Compiled from Causes and Prevention of Accidents in Lumber Manufacture, 1939, by Max D. Kossoris and Swen Kjaer. Monthly Labor Review, vol. 51, No. 3 (September 1940), tables 1, 2, and 3, pp. 663-675. U. S. Bureau of Labor Statistics, Washington.

TABLE II.—*Industrial-injury rates of the logging and sawmilling industries compared with those of all other industrial classifications; Washington, 1933–37*

Industry	Frequency rate—all injuries	Fatality frequency rate	Disability distribution per 1,000 injuries			Number of man-hours	Number of injuries			
			Fatal and permanent total	Permanent partial	Temporary total		Total	Fatal and permanent total	Permanent partial	Temporary total
Logging[1]	145. 25	3. 34	25. 6	107. 1	867. 3	124, 536, 872	18, 089	464	1, 937	15, 688
Sawmilling industries	67. 18	. 56	9. 9	121. 6	868. 5	186, 892, 231	12, 555	124	1, 527	10, 904
Sawmills and planing mills[2]	66. 02	. 57	10. 2	115. 2	874. 6	166, 339, 700	10, 982	112	1, 265	9, 605
Shingle mills	76. 54	. 49	7. 6	166. 6	825. 8	20, 552, 531	1, 573	12	262	1, 299
All other industries	37. 61	. 52	15. 8	104. 2	880. 0	1,339,285,059	50, 367	795	5, 247	44, 325

[1] Includes logging, operation and maintenance; railroads, logging (operation); shingle bolt cutting; tie cutting; log trucking; booming and rafting logs; logging rail and truck road construction and maintenance. Excludes pulpwood cutting. See appendix B, p. 72.

[2] Includes sawmills, planing mills, lath mills, and tie mills (operation and maintenance); masts (with or without machinery); pole yards (independent of logging operations) (n. o. s.), fuel and lumber yards with power-driven machinery (includes teamsters, drivers, and helpers); spars (with or without machinery); retailing of fuel oil by fuel dealers using power-driven machinery (includes drivers and helpers); lumber inspectors. Excludes creosote work, pile and pole treating, sash and door factories, cooperage manufacturing, and all remanufacture of lumber. See appendix B, p. 72.

Source: Compiled from data published in the Fifth and Sixth Reports of the Department of Labor and Industries, State of Washington.

TABLE III.—*Distribution of industrial injuries and of number of days lost in the logging industry in specified geographic regions; United States, 1939*[1]

Cause of injury	Industrial injuries							
	All regions		Western		Southern		Northern	
	Number	Percent	Number	Percent	Number	Percent	Number	Percent
All causes	4,655	100.0	2,627	100.0	1,368	100.0	660	100.0
Struck by or striking against	2,581	55.4	1,318	50.2	820	59.9	443	67.1
Falling trees, limbs, branches	527	11.3	295	11.2	152	11.1	80	12.1
Moving logs	375	8.1	138	5.3	146	10.7	91	13.8
Vehicles and machinery in motion	183	3.9	86	3.3	76	5.5	21	3.2
Axes, saws, and other hand tools	1,119	24.0	564	21.5	345	25.2	210	31.8
Other objects	377	8.1	235	8.9	101	7.4	41	6.2
Caught in, on, or between	545	11.7	268	10.2	228	16.7	49	7.5
Logs, or log and other object	199	4.3	83	3.2	85	6.2	31	4.7
Chains, cables, ropes	157	3.4	96	3.6	55	4.0	6	.9
Machinery	65	1.4	39	1.5	25	1.9	1	.2
Other objects	124	2.6	50	1.9	63	4.6	11	1.7
Falls from	441	9.5	324	12.3	88	6.4	29	4.4
Trees or logs	252	5.4	205	7.8	31	2.2	16	2.4
Platforms and ladders	36	.8	29	1.1	4	.3	3	.5
Other elevations	153	3.3	90	3.4	53	3.9	10	1.5
Falls on same level	275	5.9	190	7.2	42	3.1	43	6.5
All other causes	660	14.2	429	16.3	168	12.3	63	9.5
Unclassified	153	3.3	98	3.8	22	1.6	33	5.0
	Days lost							
All causes	792,961	100.0	522,859	100.0	221,886	100.0	84,216	100.0
Struck by or striking against	553,325	69.8	362,118	69.3	154,452	69.6	36,755	76.2
Falling trees, limbs, branches	188,864	23.8	107,341	20.5	70,037	31.6	11,486	23.8
Moving logs	115,929	14.6	85,185	16.3	21,323	9.6	9,421	19.5
Vehicles and machinery in motion	125,574	15.9	85,551	16.4	37,340	16.8	2,683	5.6
Axes, saws, and other hand tools	53,908	6.8	24,382	4.7	17,156	7.7	12,370	25.7
Other objects	69,050	8.7	59,659	11.4	8,596	3.9	795	1.6
Caught in, on, or between	79,919	10.1	50,845	9.7	25,388	11.4	3,686	7.6
Logs, or log and other object	41,335	5.2	23,449	4.5	14,687	6.6	3,199	6.6
Chains, cables, ropes	11,473	1.5	9,474	1.8	1,946	.9	53	.1
Machinery	7,088	.9	4,221	.8	2,811	1.2	56	.1
Other objects	20,023	2.5	13,701	2.6	5,944	2.7	378	.8
Falls from	74,005	9.3	57,502	11.0	11,872	5.4	4,631	9.6
Trees or logs	36,030	4.5	28,776	5.5	6,764	3.1	490	1.0
Platforms and ladders	13,631	1.7	13,553	2.6	57	(2)	21	(2)
Other elevations	24,344	3.1	15,173	2.9	5,051	2.3	4,120	8.6
Falls on same level	11,587	1.5	9,908	1.9	923	.4	756	1.6
All other causes	69,714	8.8	39,561	7.6	29,073	13.1	1,080	2.3
Unclassified	4,411	.5	2,925	.5	178	.1	1,308	2.7

[1] For industries classified under "logging" in this table, see appendix B, p. 71.
[2] Less than one-tenth of 1 percent.

Source: Compiled from special study of United States Bureau of Labor Statistics, entitled "Causes and Prevention of Accidents in Lumber Manufacture, 1939," by Max D. Kossoris and Swen Kjaer. Monthly Labor Review, vol. 51, No. 3, September 1940, pp. 663–679.

Cause of injury	Occupation of injured worker														
	Total	Buckers	Fallers	Choker setters, rigging slingers	Chasers	Hook tenders	High riggers	Whistle punks, signalmen	Loaders, tongsmen	Donkey engineers, firemen	Swampers, axemen	Railroad engineers, firemen, brakemen	Teamsters, truck and cab drivers, steam shovel and scrapermen	Tie mill, shingle bolt cutting	Section crew	All other occupations [3]
All causes	6,479	1,403	1,127	975	219	241	166	54	556	172	98	105	429	98	56	780
Hand tools	1,439	708	422	16	3	13	15	7	17	7	42		11	32	5	141
Falling trees, limbs, snags, and objects not otherwise specified	912	114	333	151	20	34	16	6	26	14	13	8	61	12	15	89
Falls of persons from different levels	918	178	127	159	48	28	27	9	111	18	13	22	51	7	3	117
From logs	703	162	100	150	38	23	18	8	64	10	13	9	23	4	1	80
From trains or trucks	101	1	1	2	4	4		1	38	3		10	20	1	2	14
Other falls from different levels	114	15	26	7	6	1	9		9	5		3	8	2		23
Falls of persons on same level	667	135	91	126	17	25	17	8	48	14	12	17	22	20	6	109
Caught or struck by cables, chokers, and tongs	563	4		207	46	50	35	8	138	12	1	4	32		1	25
Cables, lines, or chains	282	2		102	20	33	33	8	34	11		4	17			18
Caught or struck by chokers	136	1		96	20	9	1		3	1			3			2
Loading hooks and tongs	145	1		9	6	8	1		101		1		12		1	5
Handling materials	541	81	55	132	19	25	15	8	32	13	5	9	44	7	9	87
Slivers, splinters, devil clubs, and cable strands	215	39	19	70	15	15	8	3	11	2	2	2	7	1	1	20
Other	326	42	36	62	4	10	7	5	21	11	3	7	37	6	8	67
Swinging or rolling logs	463	80	19	84	37	29	5	1	97	5	4	2	55	5	1	39
Caught between objects or hit by flying objects	433	57	45	56	19	18	18	3	50	17	4	11	51	8	8	68
All other causes	543	46	35	44	10	19	18	4	37	72	4	32	102	7	8	105

[1] Includes logging, operation and maintenance; railroads, logging (operation); shingle bolt cutting; tie cutting; log trucking. Excludes booming and rafting logs; pulpwood cutting; logging rail and truck road construction and maintenance.

[2] This table contains the basic data for table 6, p. 33 of this report. It includes only permanent partial and temporary total injuries because no data classified both by cause of injury and by occupation are available for fatal and permanent total injuries.

[3] Includes dragsaw men, wood bucks, splitters, owners, superintendents and foremen, pole cutters, watchmen, pumpmen and handymen, machinists and mechanics, boom men, powdermen, bull cooks, cooks, kitchen helpers, filers, bridge crew, and all others.

Source: Unpublished tables of the Department of Labor and Industries, State of Washington, for the 2 years 1938 and 1939.

TABLE V.—*Distribution of industrial injuries in sawmills in specified geographic regions, by cause of injury; United States, 1939* [1]

Cause of injury	Industrial injuries							
	All regions		Western		Southern		Northern	
	Number	Percent	Number	Percent	Number	Percent	Number	Percent
All causes	4,768	100.0	2,391	100.0	1,968	100.0	409	100.0
Struck by or striking against	2,236	46.9	1,003	41.9	1,014	51.5	219	53.6
Power saws or other power-cutting machinery	356	7.5	159	6.6	143	7.3	54	13.2
Hand tools	262	5.5	127	5.3	104	5.3	31	7.6
Logs or lumber	1,123	23.6	497	20.8	534	27.1	92	22.5
Vehicles	93	1.9	29	1.2	55	2.8	9	2.2
Other objects	402	8.4	191	8.0	178	9.0	33	8.1
Caught in, on, or between	632	13.3	305	12.8	281	14.3	46	11.2
Machinery	240	5.0	129	5.4	96	4.9	15	3.7
Conveying equipment	165	3.5	74	3.1	79	4.0	12	2.9
Other objects	227	4.8	102	4.3	106	5.4	19	4.6
Falls—one elevation to another	283	5.9	174	7.3	86	4.4	23	5.6
Falls—on same level	288	6.0	199	8.3	76	3.8	13	3.2
All other causes	889	18.7	505	21.1	297	15.1	87	21.3
Unclassified	440	9.2	205	8.6	214	10.9	21	5.1
	Days lost							
All causes	459,849	100.0	222,649	100.0	180,288	100.0	56,912	100.0
Struck by or striking against	255,790	55.6	107,681	48.4	96,430	53.5	51,679	90.8
Power saws or other power-cutting machinery	82,940	18.0	34,765	15.6	23,906	13.3	24,269	42.6
Hand tools	12,199	2.7	4,880	2.2	2,735	1.5	4,584	8.1
Logs or lumber	110,421	24.0	46,087	20.7	47,879	26.6	16,455	28.9
Vehicles	16,477	3.6	909	.4	11,428	6.3	4,140	7.3
Other objects	33,753	7.3	21,040	9.5	10,482	5.8	2,231	3.9
Caught in, on, or between	84,342	18.4	43,976	19.8	37,778	21.0	2,588	4.6
Machinery	43,537	9.5	23,375	10.5	19,369	10.8	793	1.4
Conveying equipment	26,043	5.7	11,540	5.2	13,842	7.7	661	1.2
Other objects	14,762	3.2	9,061	4.1	4,567	2.5	1,134	2.0
Falls—one elevation to another	29,608	6.4	15,275	6.8	13,748	7.6	585	1.0
Falls—on same level	9,578	2.1	7,816	3.5	1,491	.8	271	.5
All other causes	52,929	11.5	30,356	13.6	21,140	11.7	1,433	2.5
Unclassified	27,602	6.0	17,545	7.9	9,701	5.4	356	.6

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[1] For industries classified under "sawmills" in this table, see appendix B, p. 71.

Source: Compiled from special study of the United States Bureau of Labor Statistics, entitled "Causes and Prevention of Accidents in Lumber Manufacture, 1939," by Max D. Kossoris and Swen Kjaer, Monthly Labor Review, vol. 51, No. 3, September 1940, pp. 663–679.

Cause of injury	Occupation of injured worker												
	Total	General laborers [2]	Planer operators [3]	Sawyers, all kinds [4]	Lumber pilers [5]	Green chain men [6]	Off-bearers	Doggers and block setters	Trimmer men and spotters	Edger men and edger line-ups	Truck drivers [7]	Millwrights [8]	Other occupations
All causes	3,977	1,073	314	319	484	377	154	126	149	129	179	265	408
Falling lumber or rolling logs	663	181	51	42	120	81	33	12	25	17	25	24	52
Falling trees, branches, timbers, and lumber	614	165	51	35	119	80	30	6	25	16	25	23	39
Swinging or rolling logs	49	16		7	1	1	3	6		1		1	13
Falls of persons	786	214	49	33	127	91	26	14	13	13	38	60	108
On same level	466	137	38	25	61	51	23	10	9	8	19	34	51
From different levels	320	77	11	8	66	40	3	4	4	5	19	26	57
Handling materials	771	226	61	46	124	100	16	11	26	27	34	28	62
Slivers, splinters, devil clubs, cable strands, and stepping on nails	205	53	27	7	39	20	3	2	17	8	8	11	10
Other	566	173	34	39	85	80	13	9	9	19	26	27	52
Machine causes	436	74	45	102	9	11	32	20	41	30	3	26	43
Power-driven saws, edgers, planers, etc	227	30	26	77	5	2	19		28	9		11	20
Kickbacks from power-driven saws	124	19	16	20	3	9	9	6	8	19		3	12
Mechanical power transmission	68	20	1	5	1		4	14	3	2	3	6	9
Machines not otherwise specified	17	5	2						2			6	2
Other mechanical	235	65	25	12	16	17	9	20	3	7	23	13	25
Elevators, cranes, hoists, conveyors, log carriage, and live rolls	107	18	19	6	5	10	7	18	1	5	2	7	9
Trucks, tractors, and other lumber carriers	89	35	5	1	8	5	1	1	1		21	3	8
Cables, lines, chains, chokers, tongs, and loading hooks	39	12	1	5	3	2	1	1	1	2		3	8
Caught between and bumping against objects	538	151	53	37	57	53	14	24	22	23	30	32	42
Hand tools	163	50	7	10	9	6	11	8	9	3	6	18	26
Falling objects not otherwise specified	205	70	12	7	14	11	4	13	3	5	12	27	27
Flying objects and other foreign bodies	123	28	9	26	8	7	6	2	5	4	3	16	9
All other	57	14	2	4			3	2	2		5	11	14

NOTE.—This table includes the basic data for table 9, p. 56 of this report. These tables include only permanent partial and temporary total injuries because no data classified both by cause of injury and by occupation are available for fatal and permanent total injuries.

[1] Includes sawmills, planing mills, lath mills, and tie mills (operation and maintenance); masts (with or without machinery); pole yards (independent of logging operations) not otherwise specified; fuel and lumber yards with power-driven machinery (includes teamsters, drivers, and helpers); spars (with or without machinery); retailing of fuel oil by fuel dealers using power-driven machinery (includes drivers and helpers). See Appendix B, Data from the State of Washington, p. 72.

[2] Includes general laborers, wood sawyers, laborers in fuel yards, watchmen.

[3] Includes all planing-mill machine operators except sawyers, and tiers and pullers in the planing mill.

[4] Includes sawyers, slashermen, levermen, button men.

[5] Includes lumber pilers, car loaders, truck loaders, yard men, dry shed loaders, unloaders, timber deckmen.

[6] Includes green chain tally pullers, tallymen, markers, kiln operators, stackers, unstackers, graders.

[7] Includes teamsters, truck drivers, jitney and carrier drivers.

[8] Includes millwrights, machinists, blacksmiths, carpenters, filers, electricians.

Source: Unpublished tables of the Department of Labor and Industries, State of Washington, for the 2 years 1938 and 1939.

Appendix C.—Hazardous-Occupations Order No. 4

June 24, 1941.

Occupations Particularly Hazardous for the Employment of Minors Between 16 and 18 Years of Age or Detrimental to Their Health or Well-Being

By virtue of and pursuant to the authority conferred by section 3 (l) of the Fair Labor Standards Act of 1938[1] and pursuant to the regulation prescribing the procedure governing determinations of hazardous occupations;[2] an investigation having been conducted with respect to the hazards for minors between 16 and 18 years of age in employment in occupations in logging and occupations in the operation of any sawmill, lath mill, shingle mill, or cooperage-stock mill, and a report of the investigation having been submitted to the Chief of the Children's Bureau; a finding and order relating to the employment of minors between 16 and 18 years of age in the said occupations having been proposed for final adoption by the Chief of the Children's Bureau upon the basis of the said report of investigation; a public hearing having been held with respect to the said proposed finding and order; no persons having appeared at and no statements having been submitted in connection with the said hearing requesting any change in the proposed finding and order; and sufficient reason appearing therefor,

Now, therefore, I, Katharine F. Lenroot, Chief of the Children's Bureau of the United States Department of Labor, hereby find and declare that:

Sec. 422.4. *Logging occupations and occupations in the operation of any sawmill, lath mill, shingle mill, or cooperage-stock mill.*

(a) *Finding and Declaration of Fact.* All occupations in logging and all occupations in the operation of any sawmill, lath mill, shingle mill, or cooperage-stock mill are particularly hazardous for the employment of minors between 16 and 18 years of age, except the following:

1. Work in offices or in repair or maintenance shops.
2. Work in the operation or maintenance of living quarters.
3. Work in timber cruising, surveying, or logging-engineering parties, provided that no work in the construction of roads or railroads is performed.
4. Work in forest protection, such as clearing fire trails or roads, piling and burning slash, maintaining fire-fighting equipment, constructing or maintaining telephone lines, or acting as fire lookout.
5. Work in the feeding or care of animals used in logging.

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[1] Act of June 25, 1938, ch. 676, 52 Stat. 1060, U. S. Code, Supp. 4, title 29, sec. 201.

[2] Issued November 3, 1938, pursuant to authority conferred by section 3 (l) of the Fair Labor Standards Act of 1938, and published in the Federal Register, vol. 3, p. 2640, November 5, 1938, Procedure Governing Determinations of Hazardous Occupations.

b. *Definitions.* As used in this order:

1. The term "all occupations in logging" shall mean all work performed in connection with the felling and bucking of timber into logs or converting of timber into poles, piles, ties, bolts, or similar products; the collecting, loading, transporting, or unloading of such products in connection with logging; the constructing and maintaining of roads, railroads, flumes, or camps used in connection with logging; the moving and installing of machinery or equipment used in logging, and other work performed in connection with logging. The term shall not include work where pulpwood only is logged nor work performed in timber culture, timber-stand improvement, or in emergency fire-fighting.
2. The term "all occupations in the operation of any sawmill, lath mill, shingle mill, or cooperage-stock mill" shall mean all work performed in or about any such mill in connection with converting logs into rough lumber; converting logs, bolts, or scrap wood into laths, shingles, or cooperage stock; storing logs, bolts, or scrap wood; or storing, drying, or shipping of lumber, laths, shingles, cooperage stock, or other products of such mills. The term shall not include work performed in the planing-mill department or other remanufacturing departments of any sawmill.

This order shall not justify noncompliance with any Federal or State law or municipal ordinance establishing a higher standard than the standard established herein.

This order shall become effective on August 1, 1941, and shall be in force and effect until amended or repealed by order hereafter made and published by the Chief of the Children's Bureau.

KATHARINE F. LENROOT,
Chief of the Children's Bureau.

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